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Continuous Phenothiazine Therapy For Horses

III. The Second Year of Treatment†

A. C. TODD,* Ph.D., M. F. HANSEN,* Ph.D., Z. N. Wyant,* M.S.,
D. H. Crowdus,* M.S., and M. J. CAWEIN,* B.A.,
Lexington, Kentucky

AN experiment designed to determine the effect of continuous low-level phenothiazine therapy on the physical well-being of horses and on their intestinal parasite fauna was begun at this station in late April 1948. The investigation was indicated when it was found that effective strongyle control for Thoroughbreds in central Kentucky could be obtained through the use of a system of intermittent low-level phenothiazine therapy, Todd, *et al.*[4,5,6,7]. Twelve horses ranging in age from two to 18 years were divided into four groups. The four groups have been fed 0.5 gm., 1 gm., 2 gm., and 4 gm. phenothiazine, respectively, on their grain ration at daily intervals since April 27, 1948. At the end of the first year of the test one horse in each group was sacrificed and given complete postmortem examination. In the first year of the study, a direct relation was found between amounts of phenothiazine fed and the reduction of the strongyle infection, Todd, *et al.*[3]. No significant changes were found in the erythrocyte counts, hemoglobin concentrations, mean cell volumes, mean corpuscular hemoglobin concentrations in the 12 animals, nor in the tissues of the liver, heart, lungs, kidneys and spleen of the four animals which came to postmortem, Hansen, *et al.*[1].

The present paper contains data on the continued reduction of the parasite infections of the eight remaining animals during their second year of continuous treatment. It also records results of periodic examination of the blood of these animals and has a note on the data obtained from tissue sections of the four animals sacrificed at the end of the second year of treatment.

The four test groups of horses in the second year of treatment were composed of the remaining eight of the original 12 horses. The group receiving 0.5 gm. phenothiazine was composed of a seven-year-old Thoroughbred wobbler mare and a six-year-old light-boned mare. The group fed 1 gm. phenothiazine was composed of a four-year-old Thoroughbred mare and a four-year-old light-boned mare. The group fed 2 gm. phenothiazine was composed of a five-year-old and a 19-year-old Thoroughbred mare. The group fed 4 gm. phenothiazine was composed of a four-year-old and a ten-year-old light-boned mare. The horses were maintained almost entirely in box stalls; no pasture was available and when turned out they generally had access only to a bare lot. The feed consisted of hay, oats, and corn.

Methods

A sample of manure from each of the eight animals was examined for parasite eggs at four-week intervals throughout the second year of treatment. The method of preparation of the individual manure samples for microscopical examination was outlined in the first paper of this series[3].

Blood samples from each of the eight horses were also collected at four-week intervals throughout the second year of treatment. The technic used in this work was as follows: Blood samples were collected between 8:00 a.m. and 9:00 a.m. Five milliliters of blood were withdrawn from the jugular vein into a bleeding tube containing enough ammonium and potassium oxalate mixture to make a concentration of 2 mg. per ml. of blood. A drop of blood remaining in the bleeding needle, which did not contain oxalate, was placed on a clean glass slide to make a differential smear. Differential counts were based on 200 white blood cells. Hemoglobin concentrations were measured by means of a Fisher electro-hemometer. Wintrobe's hematocrit tubes were used for packed cell volume determinations; the packed cell volumes reported are accurate to within 1%. Red and white blood cell counts were made in duplicate, the duplicate red blood

†The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the Director.

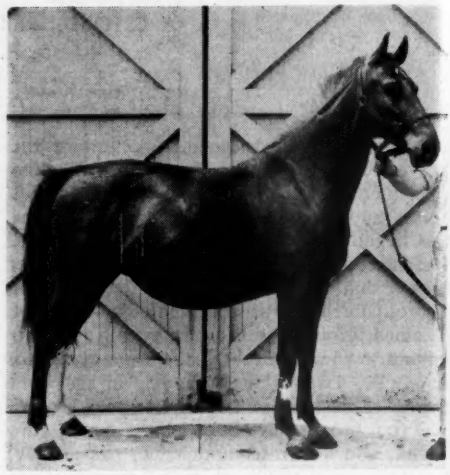
*Department of Animal Pathology, Kentucky Agricultural Experiment Station, Lexington.

cell counts must be within 500,000 cells/cmm.; the duplicate white cell counts within 1,000 cells/cmm. Counts outside the stated limits were repeated.

At the completion of the second year of the test one horse in each group was sacrificed and given complete postmortem examination. A representative collection of the parasitic population in each horse was obtained. Sections of the liver, kidneys, spleen, heart, lungs, ovaries, and uterus of each horse were also obtained.

Experimental Findings

Nature and Course of Parasitic Infections: The complete record of strongyle egg counts obtained from each of the eight horses is given in table 1. These egg counts indicate that a further considerable reduction in worm populations occurred during the course of the second year of treatment. The average egg counts in the four groups of horses at the beginning of the second year of the test were as follows: 0.5 gm., 430 epg (eggs per gram of feces); 1 gm., 70 epg; 2 gm., 190 epg; 4 gm., 10 epg. These counts, of course, are in marked contrast to the average counts of 3,107, 1,682, 2,463, and 2,220 epg recorded for the same groups of horses a year earlier. As was true in the first year of the test, worm egg counts recorded during the second full year of treatment appeared directly related to the amount of phenothiazine fed the four groups of horses (table 1). Of 26 examinations made of the two horses receiving 0.5 gm. phenothiazine daily, 23 (88.5%) were positive for worm eggs. Twenty (76.9%) of 26 samples from the 1 gm. group were positive; 14 (53.8%) of 26 samples from the 2 gm. group were positive; only 4 (15.4%) of 26 samples from the 4 gm. group were positive. Percentages of manure samples from the above four groups positive for worm eggs during the first year of treatment, arranged in the same order as above, were 97.6%, 76.2%, 57.1%, and 35.7%, respectively.



AP-94. This six-year-old mare was fed 0.5 gm. of phenothiazine daily for two years. She foaled normally ten days after this picture was taken. During the entire trials, this animal has been in good health, flesh and condition.

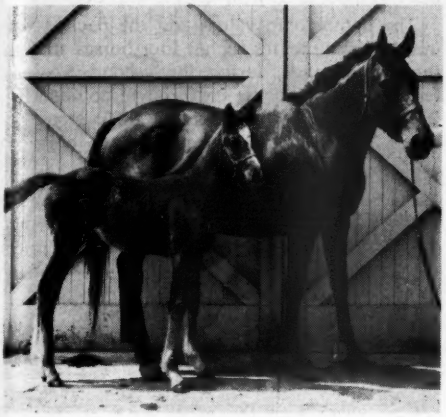
The decline in fertility of eggs actually observed, which had been noted to accompany continuous phenothiazine therapy in the first year of the experiment, was again in evidence. Of 332 eggs observed in fecal samples from horses fed 0.5 gm. phenothiazine daily, 162 (48.8%) were infertile. Thirty (39.5%) of

TABLE 1. WORM EGG COUNTS OF HORSES RECEIVING DAILY LOW-LEVEL PHENOTHIAZINE THERAPY.

		Strongyle Eggs Per Gram of Feces at Examination on Dates Shown.											
Dates Group	Horse	5-23-49	6-20	7-18	8-16	9-12	10-10	11-7	12-5	12-28	1-25-50	2-24	3-24	4-21
0.5 gm.	7-yr. m.	640	180	140	260	160	660	32	176	0	128	0	32	64
	6-yr. m.	220	360	680	640	1120	0	32	304	192	64	112	64	64
	Avg.	430	270	410	450	640	330	32	240	96	96	56	48	64
1 gm.	4-yr. m.	100	100	60	560	60	20	0	16	16	80	16	144	32
	4-yr. m.	40	0	40	20	0	0	16	32	0	32	0	16	16
	Avg.	70	50	50	290	30	10	8	24	8	56	8	80	24
2 gm.	5-yr. m.	360	180	320	120	140	20	0	0	16	16	0	0	0
	19-yr. m.	20	0	20	20	20	0	32	0	0	0	0	32	0
	Avg.	190	90	170	70	80	10	16	0	8	8	0	16	0
4 gm.	10-yr. m.	0	0	0	0	0	40	0	0	0	0	0	0	0
	4-yr. m.	20	80	80	0	0	0	0	0	0	0	0	0	0
	Avg.	10	40	40	0	0	20	0	0	0	0	0	0	0

76 eggs from horses fed 1 gm. daily were infertile. Eleven (16.4%) of 67 eggs from horses fed 2 gm. daily were infertile; and 2 (18.2%) of 11 eggs from horses fed 4 gm. daily were infertile.

At postmortem examination, the worm population of the horse examined from each group was clearly related to the amount of phenothiazine fed. Two species of the genus Strongylus, *S. vulgaris* and *S. edentatus,* were found again in each of the four horses, together with small strongyle species (cylicostomes). The seven-year-old Thoroughbred wobbler mare from the 0.5 gm. group had 11 male and 48 female *S. vulgaris* in the cecum and 4 females in the colon. The same animal had

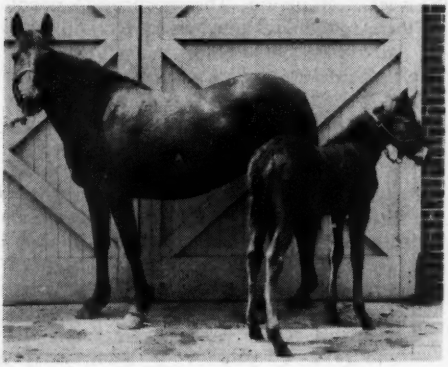


AP-96. The above is the five-year-old mare that received 2 gm. of phenothiazine on her grain feeding daily for two years. The 1950 foal of this Thoroughbred mare stands beside her.

18 male and 56 female specimens of *S. edentatus* in the colon and none in the cecum. Perhaps more than 10,000 specimens of cylicostomes were present in the large intestine. There were no bloodworms, immature *S. vulgaris,* in the anterior mesenteric artery and its immediate branches.

The four-year-old Thoroughbred mare from the 1 gm. group had ten male and three female *S. vulgaris* in the cecum and one male and two females in the colon. There were no *S. edentatus* in the cecum, but there were 55 male and 31 female specimens in the colon. Eleven immature *S. edentatus* were recovered under the parietal layer of the peritoneum. The cylicostomes were represented by somewhat less than 500 specimens. There were no bloodworms in the anterior mesenteric artery and its immediate branches.

The 19-year-old Thoroughbred from the 2 gm. group had one male and three female *S. vulgaris* in the cecum and one male and two females in the colon. There were no *S. edentatus* in the cecum; one male specimen was recovered from the colon. The cylicostomes numbered less than 200. There were three bloodworms in the anterior mesenteric artery.



AP-101. This ten-year-old grade mare received 4 gm. of phenothiazine daily for two years. Also pictured is her 1950 foal. No harmful effects of the continuous therapy have at any time been observed on either mare or foal.

The four-year-old light-boned mare from the 4 gm. group had no specimens of *S. vulgaris* in the cecum and colon. There were no *S. edentatus* in the cecum; there was a single male specimen in the colon. Not more than 20 specimens of cylicostomes were recovered from the entire large intestine. There were no bloodworms in the anterior mesenteric artery.

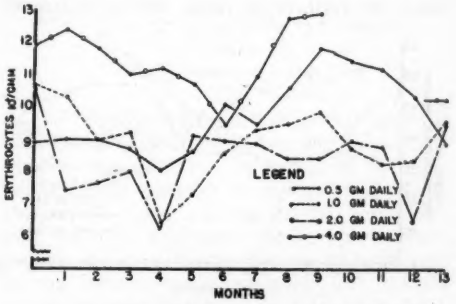


Fig. 1. Erythrocyte counts.

Hematological Studies: The blood pictures of four horses which had been on continuous low-level phenothiazine therapy for 104 weeks are shown graphically in figures 1 to 6.

There were no great differences between the erythrocyte counts of the four horses at the end of the second 52-week test period (fig. 1). The mare which received 0.5 gm. of phenothiazine daily showed a count of

8,890,000 cells/cmm.; the mares receiving 1 gm. and 2 gm. daily doses showed counts of 9,560,000 cells/cmm. and 9,420,000 cells-cmm., respectively. The mare which received 4 gm. of phenothiazine daily showed a count of 10,250,000 cells/cmm. at the end of the second 52-week test period. The erythrocyte counts of these four mares previous to receiving continuous low-level phenothiazine therapy were 8,100,000 cells/cmm., 7,800,000 cells/cmm., 6,600,000 cells/cmm., and 11,700,000 cells/cmm. The rather consistent high erythrocyte counts, hemoglobin values, and packed volumes of erythrocytes (fig. 1, 2, 3), shown by the mare receiving 4 gm. daily doses of phenothiazine are attributed to her nervous disposition which made it impossible to obtain blood samples without unduly exciting her. It has been shown that when a horse becomes excited, its erythrocyte count will be increased by a million or more cells per cubic millimeter in a few seconds, Neser[2].

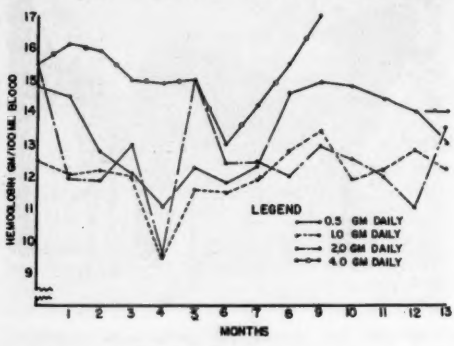


Fig. 2. Hemoglobin content.

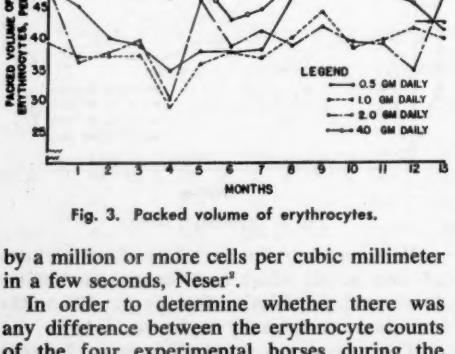


Fig. 3. Packed volume of erythrocytes.

In order to determine whether there was any difference between the erythrocyte counts of the four experimental horses during the first and second 52-week test periods, a statistical treatment of the data was necessary to determine the significance of differences between the mean erythrocyte counts for each horse for the two test periods. The mare which received 0.5 gm. daily dose of phenothiazine had an average erythrocyte count of 8,100,000 cells/cmm. the first 52 weeks of the test and an average erythrocyte count of 8,890,000 cells/cmm. the second 52 weeks of the test. The difference between these mean values approached significance at the 5% level. The mares receiving 1 gm. and 2 gm. daily doses of phenothiazine, respectively, showed no significant differences between their mean erythrocyte counts for the first and the second 52-week test periods. The difference between the mean erythrocyte counts of the mare receiving a 4 gm. daily dose of phenothiazine was not related to the phenothiazine therapy but was associated with her nervous disposition.

The hemoglobin values and the packed volume of erythrocytes for all four horses showed the same trends during the second 52-week test period as did the erythrocyte counts (fig. 2, 3). There are no extreme differences between the values obtained for each horse at the beginning and at the end of the second 52-week test period.

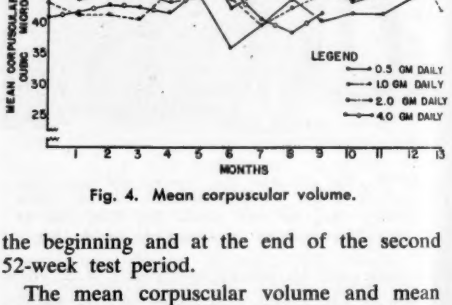


Fig. 4. Mean corpuscular volume.

The mean corpuscular volume and mean corpuscular hemoglobin concentration (fig. 4, 5) maintained rather uniform values through the second 52-week test period. No simultaneous increases in the mean corpuscular volume and the mean corpuscular hemoglobin concentration, indicating destruction of microcytes, were apparent.

The results of the leukocyte counts of the four experimental horses are shown in fig. 6. In most cases the counts follow a fairly uniform pattern when it is considered that the number of circulating leukocytes varies considerably under the influence of numerous conditions which are difficult to control. There were no important changes in the differential leukocyte counts. In general, the ratio of neutrophils to lymphocytes in all four horses was about 1.3:1. The mare receiving 0.5 gm. daily doses of phenothiazine showed a tendency to

have more lymphocytes than neutrophils. In the third and fourth months of the experiment this mare showed a ratio of neutrophils to lymphocytes of order of 1:3 (fig. 6). The mare which received 2 gm. daily doses of phenothiazine showed a leukocytosis on the twelfth and fourteenth month of the test (fig. 6). This mare showed a 3:1 ratio of neutrophils to lymphocytes.

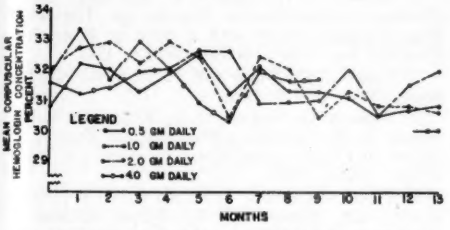


Fig. 5. Mean corpuscular hemoglobin concentration.

*Histological Studies**: At postmortem examination none of the four horses exhibited gross pathological lesions. Examination of the sections from the liver, kidneys, spleen, heart, lungs, ovaries, and uterus did not reveal any significant microscopical changes.

Discussion

The one main purpose of the present investigation has been to determine possible effects of low-level phenothiazine therapy upon the physical well-being of horses. The greater efficiency of this method of strongyle control for horses appears to be derived in large part from the consistent application of the treatment; *i.e.*, under field conditions horses are fed 2 gm. daily doses in a schedule of three weeks of treatment followed by one week of rest from the treatment. Acceptance of phenothiazine in equine practice has been conditioned in the past by unfortunate recommendations and use of the drug in therapeutic amounts which occasional horses were unable to tolerate. No such serious reactions have attended the employment of low-level phenothiazine therapy for the control of strongyle infections in Thoroughbreds in central Kentucky.

The experiment conducted at the Kentucky Agricultural Experiment Station has proceeded under particularly fortunate circumstances. The first two years of the test have not been marred by accidental injury to the horses during breeding or in foaling. The horses have not developed infections of such natures as would interfere with proper interpretation of the blood samples. The actual physical condition of the horses, as determined by regular clinical examinations conducted by the staff of the Department of Animal Pathology, has been excellent. The animals are alert and have not displayed instances of inappetence; their daily doses of phenothiazine have been mixed with their daily grain ration. One horse, the 19-year-old Thoroughbred mare, sustained a single attack of colic of very brief duration in December 1949. No other symptoms of colic have been observed in any of the horses during the two years of continuous treatment. In the past year all eight mares were bred successfully and those whose pregnancies were allowed to proceed to full term produced healthy, normal foals in the spring of 1950. The mares have been given challenge exposure with abortion-virus, and have been stabled with other mares given similar treatment.

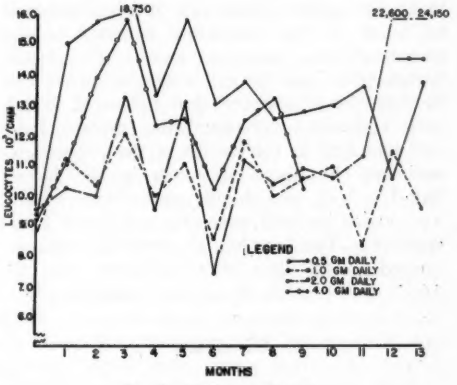


Fig. 6. Leukocyte counts.

The normal, healthy condition of the eight animals certainly is reflected by their blood pictures over the two-year period of the test. No hemolytic anemias have developed. While the overall blood pictures of the horses appear to have improved, these apparent improvements undoubtedly are due in large part to the refinement of hematological technic which occurred beginning in July 1948. First blood samples of the horses were secured in late April 1948. Certainly none of the blood pictures show a deterioration due to low-level phenothiazine therapy.

The secondary purpose of these experiments has been to determine the effects of continuous phenothiazine therapy upon the internal parasites of the horses. In this respect, particular significance is attached to the number of bloodworms, immature *S. vulgaris*, recov-

*The authors express their appreciation to Dr. E. R. Doll, Department Animal Pathology, Kentucky Agricultural Experiment Station, for the preparation and examination of the tissue sections.

ered from the anterior mesenteric artery and its immediate branches of the horses autopsied. The four horses examined at the end of the first year of treatment had 4, 0, 3, and 8 bloodworms, respectively, an average of 3.7. The four horses examined at the end of the second year of treatment had 0, 0, 3, and 0 bloodworms, respectively, an average of 0.75 worms. Twenty horses examined in 1948 at this station, and which had not received low-level phenothiazine therapy, had bloodworms ranging in number from 5 to 162, and averaged 59 worms.

The individual worm collections from the eight horses autopsied perhaps will serve a useful purpose in determining survival of particular roundworm species in the face of phenothiazine therapy. Whitlock[9] reported that pure infections with certain roundworm parasites in sheep were becoming more common with the widespread use of phenothiazine and cited the work of Turk[8] with trichostrongylosis of sheep and goats. A separate presentation will be made of the taxonomic analyses of the parasite fauna recovered from each of the horses given postmortem examination. It can be noted here, however, that strains of *S. vulgaris* resistant to phenothiazine therapy have not appeared in the horses in the present experiment. Numbers of adults in the horses fed 0.5, 1, 2, and 4 gm. phenothiazine daily and posted in 1949 were 46, 3, 42, and 1, respectively. The four horses posted in 1950, arranged in the same order as above, had 53, 16, 7, and 0 adult *S. vulgaris*, respectively.

Summary

Four groups of horses have been fed 0.5, 1, 2, or 4 gm. of phenothiazine daily for two consecutive years to determine effects of continuous low-level phenothiazine therapy on the physical well-being of the horses and on their internal parasites.

No harmful effect of the continuous therapy has been discovered. The horses have remained normal, healthy individuals. Postmortem examination of four horses at the end of the first year of treatment, and again at the end of the second year of treatment, revealed no gross or microscopic pathology related to the phenothiazine treatment.

Pronounced effects have been found upon the internal parasites. Strongyle infections have been reduced in proportion to amounts of phenothiazine fed, as shown by counts of strongyle eggs passed by the horses. A continuing effect of phenothiazine upon fertility of the strongyle eggs passed by the horses has been noted. Significant reductions have occurred in numbers of bloodworms, immature *S. vulgaris*, in the anterior mesenteric artery and its immediate branches, carried by the horses. No evidence has been found to indicate that strains of this parasite resistant to the action of phenothiazine have developed.

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The modern practices of confinement rearing of poultry have resulted in many new management problems. One of these, which is being discussed frequently is that of wet litter and its causes. James and Wheeler (*Poultry Sci.*, 28:465, 1949) reported that the amount of water consumed and the amount of excreta voided by growing chickens varied almost directly with the protein level of the diet. In a recent paper, (*Poultry Sci.*, 29:496, 1950) these investigators reported the comparative effects of fish and other meat meals, and soybean meals on urinary and fecal water elimination. Soybean meal caused greater effects, but increasing the amounts of protein by the addition of either soybean or animal proteins was followed by both an increase in water intake and in the total amounts of water eliminated in the droppings. They concluded that both soybean meal and animal proteins are possible factors in the production of wet litter.

The Rapid Diagnosis Of Contagious Canine Hepatitis By Touch Preparation Of Fresh Liver Tissue

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SHORTLY after the classical report of Rubarth[1] on contagious canine hepatitis in Sweden in 1947, the disease was recognized in the United States. Increasing reports indicate that it is rather widespread in this country, and there is evidence that the condition previously existed among our canine population but was not recognized as a specific entity until Rubarth's publication reached this country. Riser[2] in 1948, and Coffin[3] in 1948 have adequately described the salient features of the disease including the gross and microscopic changes, and quite recently Craige[4] recorded his observations on clinical diagnosis and treatment.

Since the disease often runs a rapid, fatal course, even within 24 hours after first signs of illness, early diagnosis becomes of paramount importance for the treatment and protection of other exposed dogs. This is particularly true when the disease first occurs in a litter of pups or makes its initial appearance in a kennel.

While the typical case coming to autopsy shows rather characteristic gross tissue changes on which a tentative diagnosis can usually be made, this is not always possible and histologic examination becomes necessary for differentiation from other conditions such as leptospirosis or canine distemper. Microscopically the presence of intranuclear inclusion bodies in the liver cells, Kupffer cells, vascular endothelium and histiocytes is accepted as being pathognomonic for contagious canine hepatitis. Inclusions are present in greater numbers in the liver cord cells and consequently the liver is the tissue of choice for microscopic examination. As far as the writers know, the above-mentioned authors in reporting their histopathological findings utilized the routine paraffin embedding method for tissue examination. Nowhere in the literature was mention made of the touch or press preparation technic of fresh liver tissue as a means of rapid diagnosis until Borgman, *et al.*,[5] in June of 1950, in their report of five cases, briefly stated "a rapid diagnosis was made possible by staining liver impression smears." For the purpose of record, contagious canine hepatitis was diagnosed in Colorado for the first time in August of 1948 in the Branch Pathological Laboratory, U. S. Bureau of Animal Industry, Denver, and diagnosis was made by the demonstration of intranuclear inclusions in stained press preparations of fresh liver tissue. Subsequently 16 additional cases were similarly diagnosed and in each instance the diagnosis was confirmed by histologic examination of tissue sections. In a few instances where several pups in a litter or a number of dogs in a kennel were affected, the use of this rapid method established an immediate differential diagnosis, enabling early treatment and the saving of several valuable dogs. Consequently a means of rapid diagnosis is important to the practitioner and warrants further elaboration, in our opinion.

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Material and Methods

The material included in this study consisted of stained touch preparations made from the livers of 17 cases. Of the number examined, eight cases were individual family dogs. The nine other cases represent six different outbreaks in which multiple losses were sustained. A more detailed report on these cases, involving two or more deaths in a litter or kennel, revealed the following fatalities:

1. Four ten-month-old Greyhound pups died out of a total of 30 dogs in a Greyhound racing kennel.

2. Eight valuable English Fox Hounds, nine-week to five-month-old, died out of 34 pups in the kennel. Many others were ill at the same time but recovered following treatment.

3. Four nine-week-old Dalmation pups out of a litter of ten were lost.

4. Four one-month-old mixed Collie pups from a litter of six died of the disease. The mother of these pups died a week previously of an undiagnosed condition, presumably contagious canine hepatitis, since the entire litter was affected with the disease several days later.

5. Two seven-week-old Greyhound pups, constituting the litter, died of the condition. In this instance the first pup died several days before its mate became acutely ill. No examination was made of the first case to establish the diagnosis.

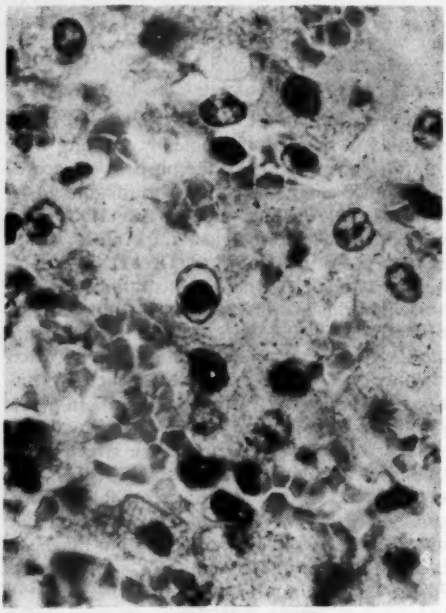

Fig. 1. Photomicrograph of a histologic section of liver showing a characteristic intranuclear inclusion body in the center of the field. X1200.

6. Three valuable two-month-old Boxer pups died out of a litter of five. The two remaining pups were ill but recovered following treatment. The first case died five days before the others in the litter were affected but was not submitted for laboratory examination. Here again diagnosis of the first case might have prevented further losses in the litter.

It must be emphasized that the number of liver cord cells containing intranuclear inclusions is quite variable, ranging from only a few inclusions in some cases to as high as 50% of the cells in others. Because of this, it is important to get as many cells on a slide as possible for examination. To accomplish this we have developed the following technic that has proved advantageous:

1. Scrape a fresh cut surface of the liver with a scalpel.
2. Place the scraped tissue between filter paper and blot out the red blood cells.
3. Spread the remaining tissue thinly and evenly on a cork.
4. Make several impressions or touch preparations on a slightly heated glass slide, applying moderate pressure. A warm slide causes the tissue to adhere better.
5. Flood slides with 10% formalin and steam gently for two minutes over a Bunsen burner to fix the tissue.
6. Wash slides in running water to remove excess formalin.
7. Stain with hematoxylin and eosin, the same as a paraffin section.
8. Clear in two changes of xylol and mount in balsam.

Other staining methods have been tried but it has been found that the hematoxylin and eosin stain gives the most consistent results.

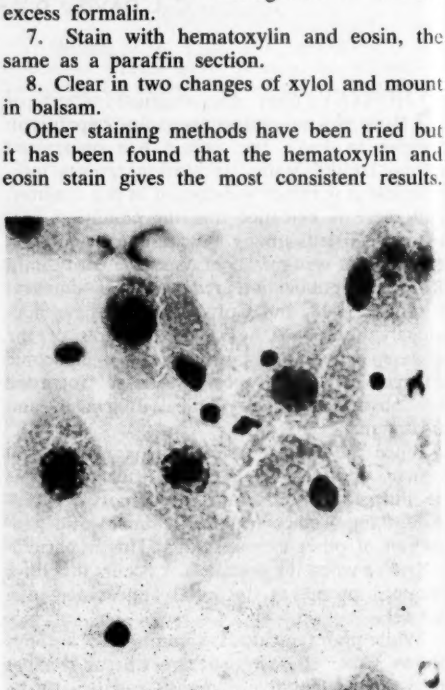

Fig. 2. Photomicrograph of touch preparation made from a fresh liver specimen from same case as fig. 1, showing several liver cells containing intranuclear inclusions. X1200.

Photographs by Glenn E. Mills, Department of Visual Education, University of Colorado Medical School, Denver.

In all, the entire procedure by this method takes not more than 30 minutes. Borgman, *et al.*, used Wright's or Giemsa's stain as well as hematoxylin and eosin for the demonstration of inclusion bodies and apparently found them satisfactory, but did not describe their technic.

If local laboratory facilities are not available, the practitioner may prepare his own formalin-fixed touch preparations according to the above outline and submit them to a diagnostic laboratory for proper staining and examination. In addition, small pieces of liver and kidney

should be preserved in 10% formalin in the event further examination is necessary.

To compare the paraffin section and the touch preparation for the demonstration of intranuclear inclusions in liver cells, a seven-week-old Greyhound pup dead of contagious canine hepatitis was selected. In tissue sections the intranuclear inclusions were obviously more sharply defined and readily seen but in touch preparations they were sufficiently differentiated to permit a diagnosis (fig. 1 and 2). In cases where inclusion bodies are so few in number as to be difficult to find in touch preparations, paraffin sections of formalin-fixed liver tissue should be made for further examination.

Summary

1. A rapid diagnosis of contagious canine hepatitis by means of touch preparation of fresh liver tissue is described.

2. The diagnosis was based on the demonstration of intranuclear inclusions in the liver cells.

3. Seventeen cases so diagnosed were subsequently confirmed by histologic section.

4. The touch preparation technic is time-saving as compared with the routine tissue section method, necessitating not more than 30 minutes for the entire procedure.

5. The importance of early diagnosis and treatment in this highly acute, often fatal disease is emphasized.

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Another Practitioner's Experiences with Mastitis

I have read with interest the article prepared by Dr. Paul Gambrel that appeared in VETERINARY MEDICINE, March 1950, entitled Mastitis from a Veterinary Practitioner's Viewpoint, which has prompted me to recite some personal experiences that substantiate some of the views expressed by Doctor Gambrel.

Here in Michigan small herds are the rule and many different milking machines are in use, some of which are in a rather sad state of repair. The matter that first shocked me upon beginning my practice here was the high incidence of mastitis in these small farm dairy herds. On study, the inefficient to dilapidated state of milking equipment, inadequate cleaning of these machines, and their improper use seem to explain poor results on many farms. Much as regards sanitation and hygiene has improved due to new and more rigid municipal controls, and much of the mastitis has been relieved in herds having a previous high incidence simply by discarding those so-called "low vacuum milkers." Such designation, in my opinion, is a misnomer. Farmers replacing this old, worn equipment with suspended type milkers, or claw-type machines of the modern type, properly operated, have saved work and worry over high milk counts and clinical mastitis.

I do not believe that many practitioners will disagree that suspended type milkers do a much more efficient job of milking, with less crawl, and in a shorter time, than is usually done with the claw-type machines. The weight of the unit, plus weight of the milk in the pail, plus the pull forward produced by the hanging arrangement, aid in keeping the teat cups down, facilitate greater ease in complete milking and thereby eliminate hand stripping. When a machine operates to do a complete job of milking in a short time, without causing excess suction and blockage of blood supply to the teat, trauma is less likely to result with subsequent infection and mastitis.

Many of the claw-type machines and "low vacuum milkers" have a tendency to creep and obstruct the blood supply in the teats, causing the so-called "blue teat" and "club teat." The manner in which some machines are operated may be responsible for breaking the skin at the sphincter, resulting in an erosion, leaving a raw sore which may allow entry of organisms and cause infection to rise in the teat meatus.

One good example may be cited in which a diagnosis of mastitis was made on first call in nine animals of a 12-cow milking herd. The owner was using a new low vacuum milker, and after observing several blue teats and some teat sores, he was asked if consideration had been given to changing machines. Several months after inaugurating careful milking practices with a suspended type milker, this herd had recovered spontaneously.

Many claw-type machines are operated in some herds by good milkers without difficulty. Their proficiency in handling the machines and

(*Continued on page* 442)

Use Of Physostigmine And Atropine In Neuromuscular Dysfunction In Small Animals*

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THIS paper reports on the use of physostigmine and atropine in a commercial solution and as tablets (Physotropin—S. F. Durst & Co., Inc.) in a series of cases covering a period of more than six months.

Physostigmine is an alkaloid obtained from the calabar or ordeal bean, *Physostigma venenosum*, which grows in West Africa. The official preparation is physostigmine salicylate. It is a cholinesterase inhibitor and its actions, therefore, are those of acetylcholine. Stimulation of a nerve results in the formation or appearance of acetylcholine (ACH) at the neurone junctions or synapses. This compound is very rapidly hydrolyzed by the cholinesterase surrounding the synapse and is attendant to the propagation of the nerve impulse. It can be seen readily that inactivation of cholinesterase results in a continued existence of acetylcholine and since physostigmine inhibits cholinesterase, the results of administration are impulses of greater duration and magnitude in the cholinergic nerves. Physostigmine, therefore, increases muscle tone and the response of skeletal muscle to motor stimuli.

Unfortunately, physostigmine produces some undesirable reactions which, however, are inhibited by the administration of atropine sulfate. Atropine may be classed as postganglionic, cholinergic nerve depressant. It does not suppress the formation of acetylcholine nor augment the action of cholinesterase, but is active through its power to desensitize certain neural fibers to acetylcholine[1]. The intensity levels of its antagonism to physostigmine vary; for example, it will suppress salivary secretion caused by physostigmine with minimal dosage while at the same time it will not inhibit the stimulation of skeletal muscle[2]. From table 1, it can be seen that a combination of physostigmine salicylate and atropine sulfate (which will be called physotropin from now on in this paper) primarily affects the nerve impulses to skeletal muscles without side reactions such as nausea and increased peristalsis.

*Material for this study was supplied through the courtesy of S. F. Durst & Co., Inc., Philadelphia 20, Pa.

TABLE 1. ACTIONS OF PHYSOSTIGMINE AND ATROPINE

	Physostigmine	Atropine
Cranial nerves	X†	— ††
Heart	—	X
Miosis	X	—
Muscles, fascicular	X	Inactive††
skeletal	X	Inactive
Nausea	X	—
Peristalsis, intestinal	X	—
ureteral	X	—
uterine	X	—
Respiration	—	X
Salivary glands	X	—
Sphincters	—	X

X = stimulated or caused

— = depressed or suppressed

† Theoretically stimulated as part of the parasympathetic system. No extensive studies are available.

†† Atropine does not inhibit the physostigmine stimulation of the trifacial nerve in quantities sufficient to fully inhibit intestinal stimulation. Its antagonism in the cranial nerves varies considerably.

With the foregoing facts established, physotropin was administered in both solution and tablet form whenever it was felt there was a possibility of benefit. There were some amazing successes and some failures, but there were enough cases which showed improvement to warrant this report.

Case Reports

The following cases are those which have been followed for at least a six-month period:

Case No. 1: A Boxer female, four years of age, was presented with a history of having suffered generalized infection three months prior to examination. There was evidence of stiffness in all joints and slight pain on movement. Diagnosis; rheumatoid arthritis.

Treatment given was limited to the intramuscular injection of 1 cc. of physotropin daily for a period of nine days. During the course of therapy continual improvement was noted and after approximately one week no pain was evidenced on pressure applied over previously sensitive joint areas, or in motion.

This patient was returned for observation one month after treatment, with recurrent symptoms. The owner reported that the animal had appeared in good condition until two

days earlier. One additional injection of the agents previously used effected complete relief at this time. There has been no recurrence for six months.

Case No. 2: Subject was a one-year-old Boxer male that was treated for virus infection approximately two months earlier. An apparently complete recovery was made in three weeks. One month later the dog was returned to the hospital with a history of weakness developing in the hind quarters. A tentative diagnosis was made at this time of inflammation of the spinal cord, meningitis; probably a sequela of the virus attack.

Physotropin, 1 cc. every other day for five injections, supplemented with one tablet t.i.d. of the same preparation on alternate days between hypodermic injections effected recovery. This animal was vigorous and healthy, and has suffered no relapses six months after treatment.

Case No. 3: Posterior paresis was observed in a four-year-old Cocker male that was presented without history of known cause. Diagnosis; disc injury (doubtful extent). Owner was warned of possible paraplegia.

Complete recovery in this dog was effected on administration of ¾ cc. physotropin daily for three days and one tablet t.i.d. for seven days.

Case No. 4: Examination of an eight-month-old Great Dane pup that had suffered injury to the left front leg two or three weeks earlier, revealed atrophy of the muscles of the shoulder region (sweeny).

In this case, treatment included the alternate administration of physotropin in injectable and tablet form five days. Dosage of 1 cc. was given every other day; intervening days three tablets were given by mouth in divided doses. No lameness was detected on examination six months later, at which time the affected shoulder appeared well muscled.

Case No. 5: A young Boxer male struck by a car suffered a fractured pelvis and compound fracture of the left radius and ulna. Damage was so severe over the forearm that radial nerve destruction was feared. A guarded prognosis was given and radial paralysis was mentioned as a possible result of the injury. Physotropin was administered as in other cases reported in this paper. Recovery was effected by splintage and radial paralysis did not develop. It is not certain that the administration of an agent designed to relieve neuromuscular dysfunction should be credited in this case. However, the animal was noted to recover more rapidly than is usual after fractures of this type.

Case No. 6: A diagnosis of myositis was made after examination of a Beagle female, seven years of age. Symptoms noted were the evidence of pain. The dog did not want to move; when standing, would not lie down. Extreme pain was evidenced on palpation over the body and limbs.

One cc. of physotropin was administered daily for three days, which was considered a large dose for the small dog. Treatment was continued for four more days by giving one tablet of the remedy each day.

Dramatic results were obtained in this case. The dog was apparently completely relieved of severe musclar pain 30 minutes after the first injection. Permanent relief was obtained by the course of therapy outlined.

Case No. 7: Arthritis in the right carpus of an aged, male Scottish Terrier responded well to the alternate use of injectable solution and the tablet form of physotropin. In this case, the animal refused to use the right foreleg. Other than sensitiveness over the carpal region, the limb appeared normal. No recurrence has been reported to date.

Case No. 8: Complete disappearance of all pain is noted on the case record of a middle-aged Cocker female. Examination of this bitch revealed symptoms of a typical cervical disc injury. The region over the neck was extremely sensitive and edematous. She cried even when approached and showed great anxiety and apprehensiveness. No *x*-ray confirmation was made of cervical disc injury due to trauma.

Treatment consisted of a combination of hypodermic injections and oral administration of physotropin.

Case No. 9: The owner of a Great Dane male, ten months of age, reported that his dog would not come out of his sleeping box in the morning when called, as was his habit. When brought out, he made repeated unsuccessful attempts to rise. Leg muscles were flaccid and would not support body weight. The animal was normal in other respects as determined by careful physical examination. No history was given that would explain the cause.

Tentative diagnosis; ventricular dropsy.

Improvement was observed after four days' treatment and complete recovery followed.

No undesirable side reactions have followed liberal use of this agent. Free use on cases of so-called meningitis in the early and later stages, where demyelination had apparently taken place, was of no obvious value.

(*Continued on page* 450)

Natural Infection Of Chinchillas With The Mouse Tapeworm, *Hymenolepis Nana Var. Fraterna**

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CHINCHILLAS appear to be relatively free of helminths, judging from the absence of reports of parasitism in them. They are susceptible, however, to infection, with concomitant pathology, by certain tapeworms of rats and mice, and dogs, all of which abound everywhere.

The first record of cestodiasis in chinchillas known to the writer is that of Bracken and Olsen[1] who identified seven cases of coenurosis (*Multiceps serialis* [Gervais, 1847]). Five of these cases were from the Colorado A. & M. experimental unit. Additional cases of what appeared to be coenurosis were observed in chinchillas from private units, but circumstances did not permit positive identification of them.

A second case of cestodiasis in a chinchilla from the college unit was observed several years ago by Dr. K. J. Peterson of the Pathology Section, but the parasites were not identified nor reported in the literature. Inasmuch as little is known regarding helminthiasis in these fur-bearing animals, it is felt that an account of this case might be of interest to veterinarians and breeders, especially since it terminated fatally.

Symptoms

The first evidence of illness in this animal was a decline in weight, notwithstanding it ate heartily. As loss of weight continued, emaciation developed and depression was apparent. Following a terminal mild diarrhea of two days' duration, the chinchilla died.

Diarrhea and depression observed in this animal were comparable to the clinical symptoms reported for children infected with *Hymenolepis nana,* the human strain of the species. According to Chandler,[2] *H. nana* may cause abdominal pain, with or without diarrhea, headache and dizziness, and nervous symptoms such as convulsions, epilepsy, and insomnia.

Autopsy Findings

Postmortem examination revealed severe enteritis. The small intestine contained a massive infection of minute tapeworms which were identified readily from preserved specimens as *Hymenolepis nana* var. *fraterna,* the rodent strain of this cestode. There was evidence of recent intussusception of the large intestine. Antemortem symptoms of emaciation were confirmed. The diagnosis of the condition leading to and resulting in the death of this chinchilla was acute hymenolepiasis.

Source of Infection and Life History

H. nana var. *fraterna* is a common parasite of rats and mice. Infection is spread between these rodents and to other susceptible animals through contamination of feed with infective

Fig. 1 (Opposite Page)
LIFE HISTORY OF HYMENOLEPIS NANA VAR. FRATERNA.

A. Infected mice contaminate feed with feces containing infective eggs. These animals serve as a natural reservoir of infection.

B. Chinchillas become infected directly when eggs from rats and mice are ingested with feed. Eggs (12, 13) entering the intestine hatch and the onchospheres (5) penetrate the villi, developing into cysticercoids (6, 7). After about five days the cysticercoids mature and leave the villi (8), attaching to the mucosa (9, 10) where they develop into sexually mature worms (11, 1) in about ten days. Autoinfection occurs when eggs (4) released in the intestine from ripe segments (2), hatch, and the onchospheres (5) penetrate the villi and develop into cysticercoids (6, 7). Development from this point is similar to that in direct infection as described above. Eggs that do not hatch in the intestine (3) pass out with the droppings.

C. Direct infection occurs when eggs passed in the feces of chinchillas, or of mice and rats, as stated previously, are ingested. Eggs entering the intestine (B, 12, 13) hatch (B, 5) and continue development as described above.

D. Eggs eaten by grain beetles, Tenebrio molitor, or their larvae, hatch in the intestines of these insects. The onchospheres migrate through the gut wall into the body cavity, and develop into cysticercoids, as shown in the figures of the insects. Rats, mice, and chinchillas may become infected by eating these insects which harbor the infective cysticercoids. Upon reaching the intestines of chinchillas, rats, or mice, the cysticercoids attach to the mucosa (B, 9) and develop to maturity (B, 10, 11, 1).

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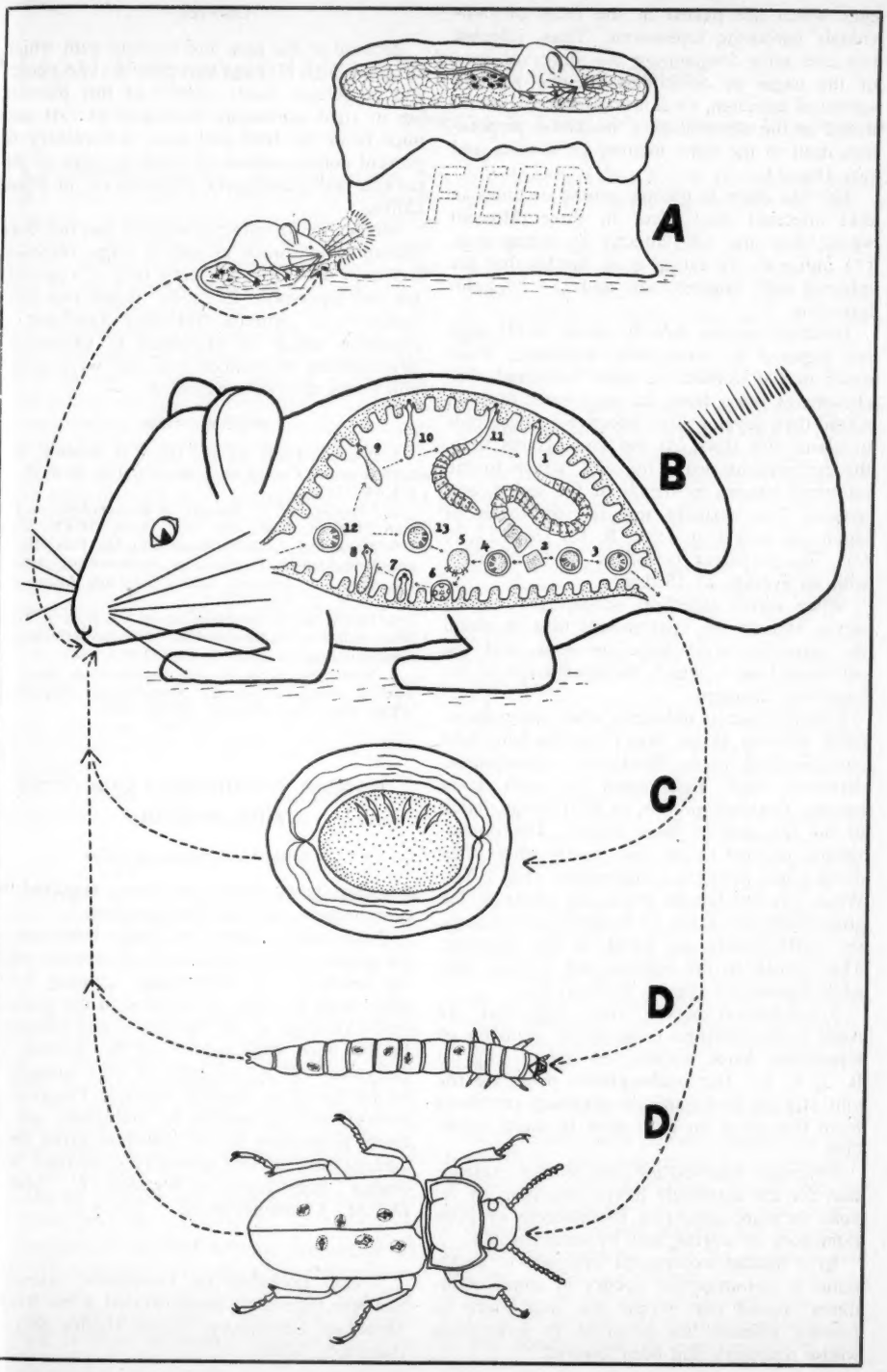
**Pathology Section, Colorado Experiment Station, and Zoology Department, Colorado A. & M. College.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Natural Infection Of Chinchillas With The Mouse Tapeworm, *Hymenolepis Nana Var. Fraterna**

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CHINCHILLAS appear to be relatively free of helminths, judging from the absence of reports of parasitism in them. They are susceptible, however, to infection, with concomitant pathology, by certain tapeworms of rats and mice, and dogs, all of which abound everywhere.

The first record of cestodiasis in chinchillas known to the writer is that of Bracken and Olsen[1] who identified seven cases of coenurosis (*Multiceps serialis* [Gervais, 1847]). Five of these cases were from the Colorado A. & M. experimental unit. Additional cases of what appeared to be coenurosis were observed in chinchillas from private units, but circumstances did not permit positive identification of them.

A second case of cestodiasis in a chinchilla from the college unit was observed several years ago by Dr. K. J. Peterson of the Pathology Section, but the parasites were not identified nor reported in the literature. Inasmuch as little is known regarding helminthiasis in these fur-bearing animals, it is felt that an account of this case might be of interest to veterinarians and breeders, especially since it terminated fatally.

Symptoms

The first evidence of illness in this animal was a decline in weight, notwithstanding it ate heartily. As loss of weight continued, emaciation developed and depression was apparent. Following a terminal mild diarrhea of two days' duration, the chinchilla died.

Diarrhea and depression observed in this animal were comparable to the clinical symptoms reported for children infected with *Hymenolepis nana*, the human strain of the species. According to Chandler,[2] *H. nana* may cause abdominal pain, with or without diarrhea, headache and dizziness, and nervous symptoms such as convulsions, epilepsy, and insomnia.

Autopsy Findings

Postmortem examination revealed severe enteritis. The small intestine contained a massive infection of minute tapeworms which were identified readily from preserved specimens as *Hymenolepis nana* var. *fraterna*, the rodent strain of this cestode. There was evidence of recent intussusception of the large intestine. Antemortem symptoms of emaciation were confirmed. The diagnosis of the condition leading to and resulting in the death of this chinchilla was acute hymenolepiasis.

Source of Infection and Life History

H. nana var. *fraterna* is a common parasite of rats and mice. Infection is spread between these rodents and to other susceptible animals through contamination of feed with infective

Fig. 1 (Opposite Page)
LIFE HISTORY OF HYMENOLEPIS NANA VAR. FRATERNA.

A. Infected mice contaminate feed with feces containing infective eggs. These animals serve as a natural reservoir of infection.

B. Chinchillas become infected directly when eggs from rats and mice are ingested with feed. Eggs (12, 13) entering the intestine hatch and the onchospheres (5) penetrate the villi, developing into cysticercoids (6, 7). After about five days the cysticercoids mature and leave the villi (8), attaching to the mucosa (9, 10) where they develop into sexually mature worms (11, 1) in about ten days. Autoinfection occurs when eggs (4) released in the intestine from ripe segments (2), hatch, and the onchospheres (5) penetrate the villi and develop into cysticercoids (6, 7). Development from this point is similar to that in direct infection as described above. Eggs that do not hatch in the intestine (3) pass out with the droppings.

C. Direct infection occurs when eggs passed in the feces of chinchillas, or of mice and rats, as stated previously, are ingested. Eggs entering the intestine (B, 12, 13) hatch (B, 5) and continue development as described above.

D. Eggs eaten by grain beetles, Tenebrio molitor, or their larvae, hatch in the intestines of these insects. The onchospheres migrate through the gut wall into the body cavity, and develop into cysticercoids, as shown in the figures of the insects. Rats, mice, and chinchillas may become infected by eating these insects which harbor the infective cysticercoids. Upon reaching the intestines of chinchillas, rats, or mice, the cysticercoids attach to the mucosa (B, 9) and develop to maturity (B, 10, 11, 1).

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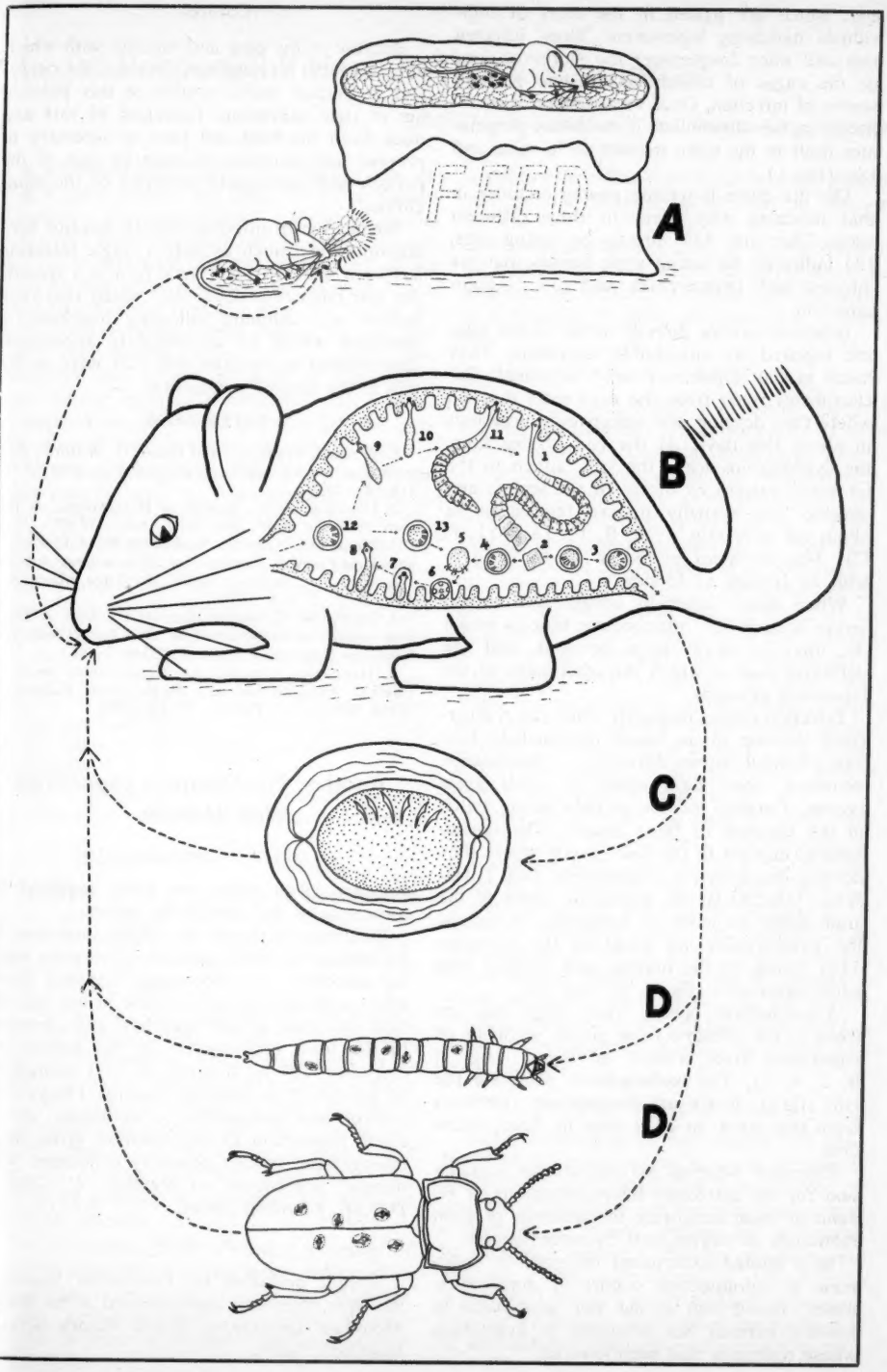
FEED
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eggs which are passed in the feces of individuals harboring tapeworms. Thus, infected rats and mice frequenting the stores of feed or the cages of chinchillas are the primary source of infection. Once the infection is established in the chinchillas, it doubtless perpetuates itself in the same manner as in mice and rats (fig. 1).

The life cycle is unique among cestodes in that infection may occur in three different ways. They are: (1) directly by eating eggs, (2) indirectly by eating grain beetles that are infected with cysticercoids, and (3) by autoinfection.

Infection occurs directly when viable eggs are ingested by susceptible mammals. They hatch in the stomach or small intestine[4]. Onchospheres freed from the eggs enter the villi where they develop into infective cysticercoids in about five days. At the end of this time, the cysticercoids leave the villi, attach to the intestinal mucosa by means of the scolex, and develop into sexually mature tapeworms in about ten days (fig. 1; A; B, 12, 13, 5-11, 1; C). The prepatent period is 14 to 25 days with an average of 15 days[3].

When direct infection occurs, the animal serves both as the intermediate host in which the infective larval stage develops, and the definitive host in which the adult stage of the tapeworm develops.

Infection occurs indirectly when the cysticercoids develop in an insect intermediate host and the adult worms develop in a mammalian definitive host. Eggs eaten by adult grain beetles, *Tenebrio molitor,* or their larvae, hatch in the intestine of these insects. The onchospheres migrate to the body cavity where they develop into infective cysticercoids[4] (fig. 1; D). When infected larvae, pupae, or adults of the grain beetle are eaten by susceptible mammals, the cysticercoids are freed in the intestine. They attach to the mucosa and develop into adult tapeworms (fig. 1; B, 9-11, 1).

Autoinfection occurs when eggs that are freed in the intestine from gravid segments of tapeworms hatch without leaving it[5] (fig. 1; B, 2, 4, 5). The onchospheres penetrate the villi (fig. 1; B, 6) and development continues from this point on as it does in direct infection.

Chandler[2] believed the only tenable explanation for the extremely heavy infections of *H. nana* in man, consisting of hundreds or even thousands of worms, was by autoinfection.

In a limited experiment designed to determine if autoinfection occurs in mice, Hunninen[5] found that it did not take place in healthy animals but occurred in individuals whose resistance had been lowered.

Control

Because of the ease and rapidity with which infection with *H. nana* var. *fraterna* can occur[3] and perpetuate itself, control of this parasite lies in rigid sanitation. Exclusion of rats and mice from the feed and pens is necessary to prevent contamination of them by eggs of the parasite and subsequent infection of the chinchillas.

Medication of infected animals has not been attempted inasmuch as only a single infection has been seen. In man, male fern is a specific for this tapeworm. Chandler[2] noted that reinfection was common following treatment, a condition which he attributed to subsequent development of cysticercoids that were in the villi at the time of medication.

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Another Practitioner's Experience With Mastitis

(*Continued from page* 437)

the care given them has been acquired by conscientious and thoughtful effort.

Practitioners should be vitally interested in the manner in which their clients operate milking machines and thoroughly acquaint themselves with the type of machine in use and the care exercised in its operation and cleaning. In this way, herd control of this nemesis of dairymen will be fostered. It isn't enough to be proficient in treating mastitis. Progress in control and prevention of outbreaks are in direct proportion to the attention given those management factors generally concerned with disease prevention. — *Wendell C. Morse, D.V.M., Charlotte, Mich.*

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Stream pollution by *Pasteurella tularensis* has been repeatedly demonstrated at the Rocky Mountain Laboratory, Public Health Service, Hamilton, Mont.

Legal Responsibilities Of The Veterinarian

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RESPONSIBILITIES of veterinarians extend beyond the limits set by applicable statutes. The conscientious practitioner wishes to avoid legal entanglements and is interested, not in merely satisfying the requirements of the law in the conduct of his professional duties, but in rendering a service that will justify his fee. In performing routine duties, he may find that unscrupulous persons try to involve him, threaten suit, or sue, in spite of professional and ethical conduct. Familiarity with medical jurisprudence serves as a guide for the prevention of loss of purse and reputation.

For many reasons, insurance to cover financial responsibility is recommended. Malpractice insurance is available to members of the A.V.M.A. in most sections of the country through the Chicago office. It is inexpensive and reliable. A variety of policies are usually obtainable locally, which will reduce, if not completely cover, money losses which might occur under the best management. Protection offered by these contracts does not prevent loss by collection of damages, but does preclude personal financial losses in successful suits. There is no insurance to protect one's reputation.

The question as to the responsibilities one must assume to avoid legal action is foremost.

Responsibilities to Clients

Exercise of that good sense acquired by living with others and consideration of the rights of neighbors or clients are the basic principles that will best assure against the risk of being sued.

Veterinarians, as a group, are infrequently involved in legal action; a credit to the personal conduct of members. Thoughtful action is required to avoid disagreeable legal procedures in such a complex society as ours. Individual veterinarians recognize that the practice of animal medicine is not a "parlor game," and that the animals man has domesticated for his use or pleasure are considered a nuisance by many persons.

As individuals, only a small percentage of the total population ever employ a veterinarian. In some sections of the country, less than 1% of the residents avail themselves of such service. It must be realized that veterinarians constitute less than 0.01% of the total population of the United States; that is, one in 10,000.

Considering these facts, it is not difficult to understand that sound judgment must be exercised in practice to avoid right of action of a plaintiff, or being subjected to a nuisance suit.

Veterinary Facilities

One must be thorough in obtaining approval for the facilities that are expected to be used before making a financial investment in real estate or setting up a practice. For example, in choosing a location, approval of the neighbors to the property, as well as other necessary civic approval as required by local ordinances, should be obtained. It is important to have thoroughly understood the nature of the work to be done. After such approval of the location by all of those who might possibly be concerned, diplomacy and consideration in relationships with neighbors or others who might become plaintiffs are imperative. People generally are sensitive to unaccustomed noises; to odors that are strange to them; and to animal excreta, which is not necessarily filth if proper disposition is made of it.

Noise seems to be the most frequent complaint against the veterinary establishment. In a residential area, the nocturnal, full-throated howl of a lonesome dog, or one which has somehow reversed good habits and slept in the daytime, disturbs a sleeper who would not be annoyed by a freight train. Many directors of veterinary hospitals or clinics employ a night attendant, whose duties usually include keeping the hospitalized animals quiet at night. That is consideration of one's neighbors, and good practice.

Liability for Malpractice

Malpractice (*mala praxis*) means bad practice. When one purports to be a veterinary practitioner and establishes himself for the practice of medicine for animals, and accepts a diseased or injured patient for treatment, he impliedly contracts that he possesses, and will use, a reasonable degree of skill, such as is possessed by the average of those who practice the profession. He further contracts that he will exercise ordinary and reasonable care,

and will apply his best judgment to the case. Still further, that he will use such available remedies and appliances as discovery and experience have found to be most expedient and beneficial to recovery; and that no injurious consequences will result from want of proper care.

The rule to remember then, is: (1) that a veterinarian is required to possess the degree of skill and learning ordinarily possessed by members of the profession; (2) that he will exercise that degree of skill and learning ordinarily exercised by members of the profession; and (3) that he will use ordinary (average) and reasonable care and diligence and the best judgment a prudent and sober person should exercise in the application of his skill to the case.

Note the requirement is to use ordinary care. The duty to exercise such care means that the practitioner will follow methods generally approved and recognized in the profession. Any departure from this may be regarded as either the result of want of knowledge or attention, or as an experiment. This is malpractice. The practitioner who fails to use the stated degree of caution may be charged with negligence. This means, in the legal sense, failure to exercise care. Negligence on the part of a veterinarian may consist of his doing something which he should not have done had he exercised prudence; or omitting to do something which he should have done were he studiously attentive; or his failure to exercise the required degree of concern.

The object of the general law, on the one hand, is to guard the owner against the wrongful practice of ignorant and negligent men who hold themselves out as practitioners of the profession, and, on the other, to protect the faithful practitioner of ordinary learning from loss in reputation or pecuniary loss on account of matters for which it would be unreasonable to hold him responsible.

The duty to exercise extraordinary care, or the specialist's care, applies in like manner compared to other specialists instead of the general practitioner.

In all of this, where services are gratuitously given, the practitioner is not absolved from the duty to use reasonable prudence. He is liable for damages and injuries or death, the same as if he were being paid.

To illustrate the foregoing, the following examples are given:

1. Suit because of misdiagnosis could be successfully defended only if reasonable care had been exercised in the examination of the animal. An error in judgment is not malpractice.

2. Liability charged because of method used that failed to accomplish resolution. In this regard, the practitioner is not bound to choose at his peril between recognized courses of treatment. If the course he chose was not the latest method recommended, he cannot be successfully charged with malpractice simply because he followed one school of thought rather than another.

3. Liability because of disfigurement or failure to effect return to normal. In this, suit for damages is made because of, for example, a crooked leg that resulted after a fracture. A practitioner cannot be held liable in such case, but is only required to exercise care in his efforts to effect proper resolution.

To recount a personal experience, though it did not involve a suit, an owner refused to pay charges for the care of a large, active dog which had been treated for a fractured femur. Hospitalization was recommended, but the owner refused and though the confinement requirements necessary for proper healing were impressed upon him, the owner tied the animal to a small shed. A short time later the inevitable tangling in the tie rope affected the splint adjustment, and the leg healed in an awkward position. The owner made the irrational reply to collection efforts that if he took his automobile to a garage for repair it was done; if the work was not satisfactory, he was not obliged to pay the charges.

A veterinarian, like any other employer, is liable to owners or custodians of animals injured through the negligence of a partner or partners, associates, employees or agents. This would include, not only negligence in diagnosis and treatment, but any inattention, including the careless operation of a motor vehicle used as an animal ambulance, inefficient operation of *x*-ray machine, or other machines or apparatus, and innumerable other illustrations. Some of these may be enumerated as: careless handling of dangerous substances, such as acids; failure to protect weak animals from fractious or vicious animals; remissness in the isolation of animals suffering contagious diseases, and others. Conversely, there is no liability for honest errors or mistakes in judgment.

The general law applicable to physicians and surgeons includes veterinarians. In this, malpractice is divided into two categories; negligent and ignorant. A practitioner under the influence of alcohol may be accused of negligent malpractice. Ignorant malpractice is that calculated to do harm; in which case,

the practitioner ought to know better. He is required to follow methods generally approved and recognized in the profession. The different schools in the practice of the arts of healing are recognized by the law.

A veterinarian is not obliged to render service to anyone or everyone who applies to him. He may refuse to respond to a call by an owner unable or unwilling to compensate him. However, unwarranted abandonment of a case, after its assumption, may make him liable for damages. Discharge by the client relieves the attendant from responsibilities.

Surgery must not be performed without the consent of the owner, except in an emergency to save life. An unauthorized operation is a trespass, and the trespasser is liable for any resulting damages. Likewise, a practitioner is responsible for error in prescription writing from which damages or injuries may result. Although well understood, and universally practiced, it might be mentioned here that in prescribing a course of treatment, it is the duty of the veterinarian to inform the owner of probable results.

Plaintiffs have the burden of establishing the breach of duty on the part of the veterinarian. The usual defenses to malpractice action are: (1) that no malpractice occurred, that is, the practitioner followed the usually accepted methods of treatment; and (2) that if malpractice is charged, that it is not malpractice, but a mere error in judgment, for which he is not liable.

Responsibility for Animals

One with whom an animal is left for care is known as a bailee. He may be a veterinarian, stable-keeper, trainer, or any of a number of custodians.

A bailee, in the absence of a special contract, is bound to use average care or diligence, in the use and protection of the animals. Here again, this means such care and diligence as persons of common prudence usually bestow upon their own property under like circumstances. The failure to so act is carelessness or negligence and in such cases, the bailee will be liable to the bailor for any damages that may follow.

One is liable for injuries occurring to animals in his charge only where neglect is proved, or when injury or loss resulting from casualties that could have been averted by the exercise of reasonable care are sustained. For illustration, the following may be cited as examples in which negligence may be charged: (1) permitting escapes; (2) communication of contagious diseases; (3) loss by theft; (4) injury or loss by attack of a vicious animal.

The matter of discharge of an animal to other than the known owner was always of considerable concern to the writer after the experience of having let someone have a Pointer an hour or so before the owner came for his dog, dressed for a hunting trip. Afterwards, it was required that any such unknown person or persons sign an affidavit that he or they had been instructed by the owner to take up the animal.

Authority to perform euthanasia should be secured in writing invariably regardless of the subject animal's condition. The strict adherence to this policy may avoid much unpleasantness.

As in other examples, a bailee is liable for the neglect of his servants of whatever designation, even though they may have violated the bailee's orders or instructions.

Contrary to the prevalent idea among a few, dogs are not considered differently than other domestic animals in the provisions of general law. There may be special jurisdictional statutes in restricted areas, regarding which one should be well informed. Dogs, like cattle or horses, are property, and proof of animal ownership is prescribed by the statutes. In the matter of strays, time and manner of take-up are usually provided by various laws.

Public Liability

Public liability of a veterinary practitioner operating an animal hospital or having only an office is covered by the general laws of negligence which apply to all business men. There is such familiarity with this sort of liability that only brief mention is made of it here.

The duty of the hospital owner or operator, including his agents, servants, employees, partners, or associates is, again so to operate the establishment that no person lawfully therein will suffer injury. That degree of care which an ordinarily prudent person would exercise under the same or similar circumstances is required, and failure to do so is negligence. Usually the constituents of ordinary care are for a jury to determine, after reviewing all of the evidence presented at a trial. Only the jury can try the facts presented.

The director or clinician in this instance is not an insurer of the safety of human beings on his premises, that is, he does not guarantee against everything and anything that might or could happen. He is merely obliged to take ordinary precautions to avoid such accidents;

failing in this, he is liable for any resulting damages or injuries.

There are different types of visitors in the category under consideration. The rule to exercise ordinary care applies only to those known as invitees on the premises. These are persons who have business with the institution, such as the owner of an animal who enters that portion of the hospital reserved for clients and those who enter to inquire about business affairs, rates, etc., even though they do not become paying patrons. Invitees have no business in any but the ordinary place allotted for their reception, unless invited into other parts of the premises by the hospital operator or his employee. If such persons go beyond the place of invitation and are injured, the operator ordinarily is not liable excepting as for licensees. Licensees are persons, like trespassers, who have no business on the operator's premises, who go on them for their own purposes, with no intention of becoming customers. The rule in these cases is, less than ordinary care—practically no care. All that an operator owes a licensee is the duty not to willfully injure him, such as might happen by setting a man-trap, pit-fall, chicken-thief shotgun, etc. The licensee accepts the premises as he finds them, and, if he finds them dangerous and unsafe, there is no liability in the absence of willful injury.

Getting back to invitees or business visitors (clients) and the rule of ordinary care as to their safety. Illustrations of liability assessed for injuries to these are; (1) the floor gave way and someone fell through; (2) a vicious animal broke into the usual place for clients (reception room) and mauled a child or injured one or more persons; (3) spilled foreign substance on the floor resulted in fall and injury; (4) chair provided in hospital lobby collapsed, (it has happened); (5) insufficient light, client fell over an obstruction he could not see; and many others. Even immediately outside the hospital door, as on the walkway in front of the building, the operator is liable for injuries due to carelessness and/or neglect, *i. e.*, portion of the sign fell causing an injury; walks were icy and snow covered and a fall resulted in injury.

If negligence is determined, damages are regularly allowed. Public risk insurance is almost universally carried by all business firms and to save financial loss, such insurance coverage is recommended to veterinarians.

Workmen's Compensation

Nearly every state in the Union has a law making it compulsory to carry workmen's compensation insurance. The purpose is to cover injuries to employees arising out of and in the scope of their employment. It applies if there are more than a minimum number of employees. In most cases, if the employer has the minimum or more employees, he and the employees are automatically included under the workmen's compensation acts.

In some states an employer or employee who does not desire to operate under the workmen's compensation act must file notice of its rejection by him. This notice must be accepted by the state commission, else he will be under the act whether he wants to be or not, and the employer will be required to pay medical expenses and compensation for any employee injured in any manner whatsoever, excepting self-inflicted injuries or injuries willfully inflicted by a fellow servant.

Most of these state acts require that insurance be carried by the employer regardless of the number employed. He may escape the insurance coverage only by permission of the state authorities if he can show financial responsibility sufficient to impress them that injured employees will be paid according to the act.

One who is not under these acts, or who has less than the minimum number of employees to come under the provisions of the law, automatically is liable for damages for injuries in line of duty under the general law of master and servant. This may be said briefly to be that the master is liable for injuries caused by his failure to exercise ordinary care to furnish employees with a safe place within which to work. It is the responsibility of the proprietor to furnish reasonably safe tools, appliances, vehicles, premises, etc. This subject would be a major discussion in itself and in view of the present-day tendency to hold employers strictly to the line in these issues, it certainly is advisable to take ample precautions against the possibility of financial loss.

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New staff members of the College of Veterinary Medicine, University of Illinois, Urbana, include Drs. Ethel McNeil, Paul B. Barto, T. R. Haupt, and Ganeswar Biswal.

Avian Navel Infection

BERT W. BIERER, D.V.M., Columbia, South Carolina

AVIAN navel infection or omphalitis, is a condition that merits the undivided attention of every veterinarian who is sincerely concerned with the welfare of our important poultry industry, now valued at $3,250,000,000. This subject deserves its place, in prominence, with many of the prevalent diseases of poultry.

Navel infection was first reported in the United States by Volkmar in 1929. Brandly, in 1932, reported on the disease more extensively and was the first to suggest formaldehyde fumigation as a possible means of controlling the disease. Hinshaw, and Williams and Daines have studied the condition in poults and have contributed to information on the subject.

Any bacteria capable of producing disease are more or less capable of producing navel infection in some form. This includes all of the pus producers, all of the Salmonella, and a host of other bacteria which possess a greater or lesser degree of pathogenicity. The writer believes he has incriminated *Salmonella pullorum, Sal. typhimurium,* strains of *Escherichia coli,* Arizona and other paracolons organisms, *Aerobacter aerogenes,* and species of Proteus and Staphylococcus. He is inclined also to favor the idea that perhaps some of the serious outbreaks of avian staphylocosis coming under his observation, characterized principally by joint involvement, may have had their infectious origin in the navel, the disease assuming a gradual course of development comparable to rheumatic fever in man.

Mushy Chick Disease

There are two forms of navel infection, designated by the terms mushy chick disease and the so-called dry form of navel infection. In mushy chick disease, birds appear to be more or less soft when handled. Birds dead of this disease may have an objectionable odor which is characteristic. Most experienced hatcherymen are familiar with the condition and usually know how to handle the trouble when confronted with it, by stringent sanitation and more exacting fumigation procedures. This anomaly is one that can be recognized by an experienced operator. It is seldom encountered in the field, because it is the aim of every poultryman to produce chicks or poults that will live. No hatchery can long remain in business if the livability of its birds is not satisfactory. Since mushy chicks or poults can be recognized by the poultryman, such birds will usually be culled from shipments at the time of packing.

While mushy chick disease is a form of navel infection, it does not necessarily involve the avian navel cord and, therefore, it markedly differs from navel diseases of other farm animals. The unabsorbed egg yolk is drawn into the body of the nearly developed chick or poult a short time before hatching. A navel is thus formed when the layers of abdominal tissues close the area where the yolk entered the abdomen. The avian navel in a 20-day embryo is button-like in appearance, and three prominent blood vessels emerge from it to communicate with the extra-embryonic structures of the egg. (Fig. 1.) A vestigial stub-like structure is centrally located in the navel, which directly communicates with the egg yolk. It is this stub-like structure which is consistently infected in the so-called dry form of navel infection.

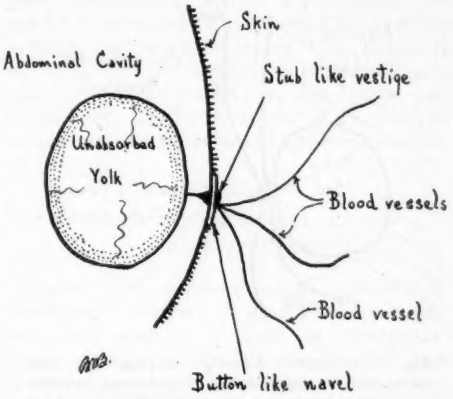

Fig. 1. Diagrammatic sketch showing structure of navel region of 20-day chick embryo.

Thus, in birds, there are two possible routes of navel infection. One, a kind of cord involvement, and the other, an infection that enters through a poorly closed navel, the abdominal cavity and subcutaneous tissues and that spreads rapidly throughout the body. When gas-forming bacteria are involved, as they usu-

ally are, a mushy chick or poult results. It is the opinion of the writer and others, that mushy chick disease results from other factors than infection alone. In all probability there has been an error or an operational accident during incubation, sufficiently serious to interfere with the efficient closure of the navel, providing a more or less fertile field for infection at hatching time.

Dry Form of Navel Infection

The so-called dry form of navel infection should be of paramount and special interest to

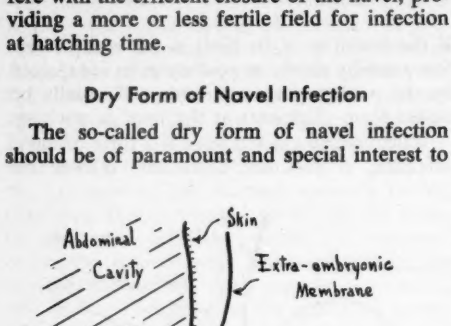

Fig. 2. Schematic drawing showing egg yolk connection, through partially closed navel, to extra-embryonic membrane of 19 to 20-day embryo. After the extra-embryonic membrane tears free, it is the remaining cord-like structure which usually is involved in the dry form of navel infection.

every poultry-minded veterinarian. The dry form of navel infection involves the cord and is more analogous to navel diseases of suckling animals. As indicated, it is usually the vestigial stub-like structure of the navel of the 20-day embryo, that becomes infected in the dry navel. On casual consideration, it is easy to overlook the fact that a kind of navel cord is involved in the hatching of the chick or poult. At hatching time, the cord, now relatively dry, is torn free at the navel. (Fig. 2.) It is further easy to overlook the fact that a baby chick has a navel at all. The relative size of a bird's navel, as compared to that of other farm animals, is so small, that this possible error is easily explained. Thus, navel infection readily can be overlooked on postmortem examinations. Further, the diagnosis of this condition is a controversial subject. There is no special test to clinch the diagnosis. Because of this, the diagnostician should hesitate to be drawn into a matter that may end up in a claim against a hatcheryman, because it is often difficult or impossible for him to prove that navel infection exists, even though he believes it does. If the navel abnormality should be due to *Sal. pullorum* or other Salmonella, then a diagnosis of pullorum disease or paratyphoid infection is made, on proper identification of the species of bacteria involved. In cases of this kind, an escape is thus provided from the controversial diagnosis of navel infection. However, in all suspected cases, it becomes the moral obligation of the diagnostician to talk the matter over with the responsible individual of the hatchery involved, so that corrective measures can be instituted.

This dry form usually manifests itself more or less as a specific disease entity. It may occur, and often does, entirely independent and, in the absence of mushy chick disease. Hatchability may be excellent. Chicks appear to be healthy and normal and, as such, are shipped to customers by the unsuspecting producer. In the field, the chicks appear normal and healthy,

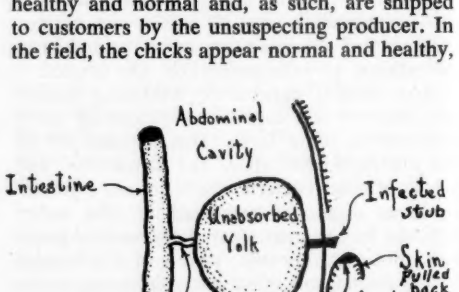

Fig. 3. Diagrammatic sketch showing usual dry form of infected navel in six-day baby chick.

for the first two or three days; then losses usually begin on the fourth, reach a peak by the sixth and usually cease by the tenth day. Losses may continue, if the bacteria of the navel infection are capable of producing an infectious disease, but the losses from the disease, as such, usually cease spontaneously.

The navel of a chick is located along the median line of the abdomen, near the vent. A scab is present over an infected navel. When the skin of the abdomen is carefully pulled away from the subcutaneous tissue, the definite diseased stub is revealed. (Fig. 3.) Infection usually follows the stub to the unabsorbed egg yolk, invading the yolk sac contents and producing a change in its consistency. This change more or less blocks absorption of the yolk. In some infections, this is marked, in others less so, depending on the species of bacteria involved and possibly other factors. In baby

chicks, the yolk should all be absorbed by the fifth or sixth day. Absorption is supposed to take place directly into the vascular system of the sac. The writer believes that yolk also may more or less ooze through the yolk duct directly into the intestine. This can be demonstrated by applying pressure over the yolk sac of two or three-day-old chicks. In the developing embryo, the yolk is probably under little pressure, and absorption is perhaps the exclusive means of utilization. However, within the abdominal cavity the yolk is subject to pressure from body activities in such a manner that the yolk sac cannot yield as it would in the developing embryo. This is important from the standpoint of the pathologist, because an infected yolk would soon produce an intestinal infection. One can also observe in cases where the egg yolk is unabsorbed after the fifth or sixth day, as is usually the case in the dry form of navel infection, that the material is of such consistency that it will not pass through the yolk duct when pressure is applied.

Whatever the case may be, the invading organisms are discharged or pass by means of continuity of tissue, through the yolk duct, to the intestines. An intestinal infection, resulting in enteritis, is thus established. The enteritis results in diarrhea, a soiling of the down around the vent, and pasting. The diarrhea results in rapid dehydration which the chicks are unable to offset by intake of fluid. The swollen inflamed intestine in the duodenal loop prevents or inhibits escape of bile into the duodenum, resulting in retention of bile in the gall bladder and enlargement of that organ. If Salmonella are involved, then other lesions typical of Salmonella invasion will be present, the most typical being a progressive change of the cecal contents from a milky substance to a more or less hard, cheesy core.

Accurate history is an important aid in making a diagnosis of navel disease. A hatcheryman may contend that if birds on other farms from the same hatch are holding up, then the birds on Mr. Jones' farm could not possibly be dying from navel infection. Well, Mr. Hatcheryman can be drawing a false conclusion. He may believe he is doing an efficient job of sanitation and fumigation, yet may be inefficient in one or more details. This results in incomplete fumigation, the effective strength of the fumigant being spent, before all of the eggs are properly fumigated. A portion of the eggs of the same hatch, may be improperly fumigated and chicks from this portion of the hatch, alone, may become affected.

Primarily an Incubator Infection

While under certain conditions, navels of individual chicks or poults may become infected in the field after shipment of the birds, it must be looked upon as being primarily an incubator infection. An incubator for hatching chicks or poults maintains all of the ideal conditions for growing pathogenic bacteria; temperature around 100 F. and presence of adequate moisture. If food for bacterial growth is also available, in the form of filth, then masses of bacteria will grow rapidly in the incubator. The air which is circulating, usually by forced draft, will likewise become saturated to a degree, with bacteria, which, if pathogenic, will produce navel infection during the hatching process. This is what happens when sanitation is faulty, or when fumigation to control incubator bacterial growth is improperly performed, or, when the species of bacteria involved are able to withstand ordinary methods of fumigation.

Fumigation and Sanitation to Prevent Navel Infection

Avian navel infection can be prevented by instituting a program of strict hatchery sanitation and exacting methods of fumigation. Proper fumigation alone is sometimes all that is needed to remedy the trouble. Normal procedure may be based on the use of 20 gm. of potassium permanganate and 40 cc. of 40% formaldehyde to each 100 cu. ft. of incubator space. When navel infection is a problem, this may be doubled safely. Egg fumigation should be undertaken after the eggs have been transferred from the setting to the hatching trays, just before they have begun to pip, and after the temperature and humidity have been brought up to their proper peaks. If the temperature and humidity are not brought to proper levels, disinfection may be inefficient or even ineffective. The cubic content of the incubator is calculated by using outside measurements.

Certain other points are important for efficient fumigation. The bowl should be at least ten times the capacity of the combined volume of the potassium permanganate and formalin to prevent overflow, and should be of crockery or enamelware. Glass, while satisfactory, may crack. Formalin should be kept in a tightly stopped bottle. If the bottle has been opened over two months, the contents should be discarded. Never attempt to use old formalin by increasing the quantity.

Place the bowl in the incubator near the air inlet if possible. Combine the potassium permanganate and formalin and quickly close the doors and keep them closed until it is time to remove the hatch.

Scabby Navels—Rough Navels

Rough navels is the term applied to a rough condition of the bird's navel, resulting from high temperature or wide temperature variations or low humidity in the incubator. Such a navel is not infected but is probably more susceptible to infection.

While infected navels are covered by scabs, all such navels are not necessarily infected. In the newly hatched chick, the navel can be revealed by blowing the down back and it may be covered by a small scab. In some birds, in the same normal hatch, a more prominent scab will be present. In poults, varying degrees of healing appear to be more or less characteristic. Some may be covered by relatively large, prominent scabs. While scabby navels may be completely healed in three days, the writer kept a number of specially selected poults whose navels were covered by large scabs. In some, it took over ten days for the scabs to drop. One laboratory, on examining birds from the same lot, had erroneously made a diagnosis of navel infection, based on the presence of scabby navels alone. It is important to learn to diagnose navel infection, and, in fairness to all parties concerned, it is equally important to be able to detect when the navels are abnormal, yet not infected.

Closing Remarks

The writer wishes to impress on the reader the importance of this subject and of being able to detect the so-called dry form of navel infection. There is nothing more distressing to a hatcheryman, than to have his chicks or poults die in the field. The livability of his product has a direct bearing upon the security of his business, his home and his own personal well being.

Unlike so many other conditions, this one can be corrected. Good results can be obtained and the veterinarian properly handling the incident will receive the everlasting gratitude of the poultryman. The writer is inclined to believe that there is no other disease condition coming within the realm of veterinary medicine, which, if properly handled will give the veterinarian more prestige. Measure the hatchery and figure out the cubic feet content. Figure the necessary amounts of potassium permanganate and formalin required for efficient fumigation. Prepare marked containers for the hatcheryman, to accurately dispense these amounts. Obtain a bowl of the proper size and material. Go over all the points of hatchery sanitation, and follow through to assure best results.

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Use of Physotropin and Atropine in Neuromuscular Dysfunction in Small Animals

(*Continued from page* 439)

Summary

1. A combination of physostigmine salicylate and atropine sulfate (physotropin) used as injectible solution and as tablets in neuromuscular dysfunction in small animals has proved beneficial in many cases of acute and chronic neuromuscular dysfunction.

2. A series of nine cases covering the following conditions is reported: rheumatoid arthritis, inflammation of spinal cord, intervertebral and cervical disc injury, atrophy of muscles following injury, myositis, ventricular dropsy, and as routine during fracture repairs.

3. Results are from good to excellent in cases as listed, without undesirable side reactions.

4. Physotropin was used in cases of so-called meningitis in both early and late stages where demyelination had apparently taken place. It had no value in these cases.

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2. *Ibid.*

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Merck research chemists identify vitamin B_{12} as a cyano-cobalt coordination complex. Oxidation reduction of this vitamin resulted in the distillation of hydrogen cyanide.

Studies reported (*Science*, 112:354 [Sept. 29], 1950) indicate that conversion of vitamin B_{12a} to vitamin B_{12} is structurally a replacement of a hydroxo with a cyano group in the molecule.

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Government purchases of dried eggs this year exceed the largest annual military purchase during World War II.—*Poulry Digest.*

The Use Of Water Miscible Vitamin A For Lambs*

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AS A part of studies on the vitamin A and carotene requirements of ewes and lambs, it was desirable to determine a means of quickly furnishing a high serum and liver content of vitamin A in these animals.

The animals used were lambs eight to ten months of age that had been stabled and fed a ration composed of prairie hay and wheat bran for five months. Some had received a supplement of glaubers salts and limestone. Serum calcium determinations showed that they were all suffering from a hypocalcemia, and a vitamin A deficiency was suspected. Subsequent analyses of blood serum and liver for vitamin A showed that in only a few instances was the liver vitamin A content low enough to be considered pathological.

Serum and liver vitamin A content determinations were made by the same methods as previously reported[1].

Procedure

Biopsy portions of liver were obtained from the lambs by use of local anesthesia. An incision was made just posterior to the sternum, on the right side of the median line. The specimens were removed by pressing off portions of liver up to 2 gm. in weight by means of two simultaneously applied Ochsner forceps. Hemorrhage was controlled by means of thromboplastin†.

The wounds were sutured with either umbilical tape or catgut sutures after each biopsy section was removed. Approximately 24 hours after giving the supplement the lambs were killed. Two biopsy specimens were removed from each lamb; one a pretreatment sample and the other two to four hours after dosing.

The materials tested were fish oil; water miscible oil concentrate; water miscible, injectable oil concentrate; and carotene in cottonseed oil. Tests were made by intravenous, intramuscular, and oral dosing. No carotene was given parenterally since Klosterman and Light[2] have shown that carotene injected intravenously is found in the lungs with no increase in the liver content of vitamin A. One hundred and fifty TR units of hyaluronidase§ were included in the intramuscular injections. It has been shown previously that this enzyme aids in the rapid distribution of solutions that have been injected intramuscularly into sheep[3].

All concentrates contained 30,000 I.U. of vitamin A per gram and a standard dose of 7,500 I.U. per pound body weight was used. The carotene was calculated to the equivalent amount of vitamin A so as to be directly comparable.

Samples of blood serum were obtained simultaneously with the liver samples. These were taken from the jugular vein. Results of these experiments are summarized in table 1.

Discussion

The concentration of vitamin A in the liver appears to be of more significance than does the content of the blood serum. Comparing the average gain for the two similarly treated sheep of six groups in the amount of vitamin A in the liver, the following results are given: Intravenous administration 261 I.U. per gram; intramuscular administration (injectable) 230 I.U. per gram; intramuscular (water miscible) 135 I.U. per gram; oral (water miscible) 97 I.U. per gram; oral (oil) 97, and oral carotene, 3 I.U. per gram.

Our previous findings[1] had shown that at the time of birth a lamb's liver has a very low vitamin A content. Studies by Hoefer and Gallup[4] showed that carotene is rapidly converted into vitamin A and stored by feeder lambs. Pope, Phillips and Bohstedt,[5] and Weir, *et al.*,[6] have shown that lambs at birth have a very low serum vitamin A but that it is rapidly raised following the ingestion of colostrum.

Hoefer and Gallup[7] had previously found alfalfa meal was superior to carotene as a source of vitamin A for lambs, but that fish

*Progress Report on Project Purnell 132—The Vitamin A Requirements of Ewes and Lambs. Published with the permission of the Director, North Dakota Agricultural Experiment Station, Fargo.

**Departments of Veterinary Science and Animal Husbandry, North Dakota Agricultural Experiment Station, Fargo.

†A trade name for an extract of cattle brains used to hasten the coagulation of blood.

§Hyaluronidase is marketed under the trade name of hydase. This material is packaged as a sterile desiccated powder which is dissolved by injecting 1 ml. of sterile saline into the vial and transferring the material to the fluid to be injected into the patient.

liver oil containing the preformed vitamin was superior to alfalfa meal as determined by liver storage.

Klosterman and Light[2] report no increase in the liver storage of intravenously injected carotene. This is not the case of intravenously injected water miscible vitamin A as shown in

TABLE 1. VITAMIN A CONTENT OF SERUM AND LIVER AFTER ADMINISTRATION OF VITAMIN A CONCENTRATES.

Sheep No.	Method of Dosing	Blood Serum Vitamin A Time (hr.)	Blood Serum Vitamin A I.U./ 100 ml.	Liver Vitamin A Time (hr.)	Liver Vitamin A I.U./ gm.
907	I.V.	0	88.8	0	24.3
	water	3.8	2331.6	3.9	127.8
	miscible	23.6	889.2	23.7	286.1
911	I.V.	0	109.5	0	39.9
	wat. misc.	4.1	2331.6	4.3	55.9
	injectable	23.8	582.9	23.8	301.5
1478	I.M.	0	88.8	0	87.4
	water	3.7	93.0	3.8	78.3
	miscible	23.5	58.8	23.5	100.5
905	I.M.	0	75.3	0	54.6
	water	2.9	344.7	3.2	67.1
	miscible	22.8	755.4	22.9	312.8
906	I.M.	0	117.6	0	122.1
	wat. misc.	4.0	424.2	4.2	138.7
	injectable	24.6	1190.4	24.6	369.4
909	I.M.	0	162.9	0	68.4
	wat. misc.	4.1	559.5	4.2	82.6
	injectable	23.5	1318.8	23.5	283.1
1479	O.	0	61.5	0	97.6
	water	3.2	55.8	3.4	109.3
	miscible	23.1	113.4	23.1	269.8
1484	O.	0	117.6	0	210.4
	water	2.0	95.7	2.1	197.6
	miscible	22.0	269.4	22.0	232.3
1480	O.	0	55.8	0	56.7
	vitamin A	3.2	68.4	3.3	91.6
	in oil	22.9	120.3	23.9	168.9
A214	O.	0	101.4	0	23.5
	vitamin A	3.1	73.8	3.2	35.6
	in oil	23.4	123.0	23.4	105.7
908	O.	0	99.6	0	13.7
	carotene	3.0	95.7	3.1	13.8
	in oil	21.8	95.7	21.7	10.3
1472	O.	0	75.3	0	63.2
	carotene	2.9	65.7	3.1	64.4
	in oil	21.7	51.9	21.7	59.4

I.V.—Intravenous; I.M.—Intramuscular; O.—Oral.

sheep 907 and 911. In the case of sheep 907, the water miscible but not injectable concentrate was used.

The intravenous injection of water miscible vitamin A would not be recommended as a therapeutic measure since the intramuscular injection with hyaluronidase was nearly as efficacious. Postmortem examinations made 24 hours after these intramuscular injections showed that the oily material was present only in a slight amount and that there was no induration of the muscle.

Summary

The intramuscular injection of a water miscible vitamin A concentrate is followed by rapid increase in the serum vitamin A and storage of vitamin A in the liver of lambs.

The authors wish to thank Wyeth, Inc., Philadelphia, Pa., for the different vitamin A concentrates and the hyaluronidase used in these experiments.

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Radioisotopes in Scientific Research

Radioactive isotopes are coming into widespread use in scientific research. The new tool actually labels elements so that determinations can be made as to just where the element has gone into the body, how much of it reaches a given tissue, and just how long it stays there. Many, but not all, elements have useful radioisotopes. Important in animal nutrition studies, for example, are calcium, phosphorus, potassium, sodium, iodine, sulfur, iron, cobalt, and zinc.

The progress of work in this field is expected to add information for more thorough understanding of life processes. Findings can then be reduced to practical measures of management that will influence livestock health, production and reproduction.

The Effect Of Bacon Brine On Pathogenic Microorganisms

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THE object of this work was to investigate the bactericidal effect of brine used for curing pork on certain pathogenic microorganisms which may be transmitted to man through eating contaminated meat. Many accidents have been reported after the consumption of bacon, ham, sausages, etc., eaten in many countries after being pickled and/or smoked. This might suggest that bacon brine is not strong enough to kill microorganisms, which invade the meat either during the animal's life or after slaughter during the dressing of the carcass or preparation of the flesh. To ascertain this, the bactericidal action of one of the most commonly used brines in the curing process has been tested.

Methods and Materials

Since it was the aim to determine the period in which the particular organisms remained viable, it was decided to examine the bactericidal action of pure brine alone and also in presence of pork. For this purpose a pickle was made which consisted of 200 gm. sodium chloride, 50 gm. cane sugar, 3.5 gm. potassium nitrate (saltpetre) and 1,000 ml. of water. When the solids were dissolved, the solution was filtered, distributed in test tubes, 10 ml. capacity, and finally autoclaved at 120 C. for 20 minutes. This brine had a salt concentration of 20%; its pH 7.4.

When meat was incorporated, about 3 gm. of minced pork were placed in a test tube to which 10 ml. brine were added and then autoclaved. In the presence of meat the salt concentration of the brine was found to be reduced to 15% and the reaction became on the acid side; the pH being 6.5.

Organisms Tested

Organisms known to affect man through eating contaminated meat were chosen for this work; these are:

1. *Salmonella typhimurium*
2. *Pseudomonas aeruginosa*
3. *Staphylococcus aureus* (Hemolytic strain)
4. *Escherichia coli*
5. *Brucella suis*
6. *Proteus vulgaris*

Tubes containing brine alone and bacon-treated meat were seeded with the particular organism under test. The inoculum was 0.1 ml. of a 24-hour broth culture.

In order to determine the bactericidal action at different temperatures, three sets of tubes were inoculated with each organism for incubation at 8 C., 22 C. and 37 C. Loopfuls from the tubes were taken at various intervals (up to 47 days) and streaked on agar plates which were subsequently examined for growth after 48 hours' incubation at 37 C.

Results

The results indicate that under the conditions of the experiments bacon brine has a feeble germicidal action on the organisms examined.

In brine-treated pork, *Br. suis* survived 47 days of curing at 8 C.; 21 days at 22 C.; and ten days at 37 C. Even when kept in pure brine without a nutrient medium, growth was still obtained on the tenth day after incubation in a curing temperature of 8 C. and on the third day after incubation at 22 C., but the organisms were killed after one day at 37 C.

Sal. typhimurium was still giving good growth after 47 days of pickling in presence of meat at 8 C.; 36 days at 22 C. and seven days at 37 C. When suspended in pure brine, growth was still obtained after ten days and seven days at 8 C. and 22 C., respectively; but was killed after one day at 37 C.

Proteus vulgaris was still alive after 36 days of curing in presence of meat at 8 C.; 27 days and ten days at 22 C. and 37 C., respectively. In brine alone, the organism ceased to live after seven days and two days at 8 C. and 22 C., respectively; while it was killed after one day at 37 C.

E. coli, in presence of meat, survived 47 days at 8 C.; 21 days at 22 C., and seven days at 37 C. In brine alone it survived 21 days

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at 8 C., seven days at 22 C. and was killed after one day at 37 C.

Staph. aureus proved to be the most resistent organism. It was still living after 47 days' curing at 8 C. and 22 C. whether meat was present or not. At 37 C. it survived 36 days in presence of meat, but only survived one day in brine alone.

Ps. aeruginosa survived 16 days' curing at 8 C. and ten days at 22 C., but did not survive after one day at 37 C. In brine alone, however, it survived seven days at 8 C. and 22 C.; while it was killed after one day at 37 C.

Discussion

To determine whether the period normally adopted in curing, (usually ten days), is sufficient to affect the viability of bacteria, the organisms which are likely to be transmitted to man through eating infected pickled pork were tested. The results of the experiments carried out showed, on the whole, considerable resistance of the organisms to the action of brine for periods ranging from one to 47 days, whether they were suspended in pure brine alone or in brine with meat.

When assessing the bactericidal action of the pickle, the properties of the material which are bound to interfere with the growth of bacteria, namely, its salt concentration, pH, and the temperature of curing have all been taken into consideration.

In the first place, the final salt concentration in pure brine was determined by means of a salometer and found to be 20%, which seems strong enough to sterilize infected meat. The pH, however, was found to be 7.4, a reaction which is known to be favorable for the growth of the majority of pathogenic microorganisms. Consequently, the antiseptic action of pure brine lies in its high salt concentration.

When pork was added to the brine, simulatting thus to a great extent the curing process, both the salt concentration and pH were found to change. The former was reduced to 15%, and the reaction became acid as a result of the lactic acid liberated from meat. This slight acid reaction on the brine is another antiseptic factor which may compensate for the lowered salt concentration.

At first glance, one would expect that such a relatively high salt concentration and an acid reaction of the medium should have a deleterious effect on bacteria that might gain access to the brine. Nevertheless, contrary to expectations, the organisms tested appeared to thrive for a long time, being quite indifferent to these antagonistic environments. Apart from supplying a nutrient medium, meat appears to provide appropriate oxidation reduction potentials which are so vital for the life of bacteria; it also acts as a buffer, minimizing thus, to a large extent, such unfavorable conditions as might interfere with their growth. Indeed, cooked meat medium is used for keeping laboratory stock cultures. In this medium many delicate organisms have been found to keep well for years.

As regards the curing temperature, it is only feasible that the higher the temperature, the more effective is the brine in killing bacteria, since there is a further factor (heat). Curing at 37 C., however, is of some interest only from the bacteriological point of view, as it cannot be adopted in practice. Curing at 22 C. is also of no practical importance for the trade. Meat preserved in this temperature, however, can be of some value for home use only when consumed shortly after it has been pickled.

The fact that the organisms suspended in pure brine alone were destroyed after a shorter time can only serve as proof that the bactericidal action of brine on microorganisms is stronger and quicker when there is no nutrient medium present. From the meat inspection point of view, that fact has no significance since bacteria will never lack a nutrient medium during the process of preserving meat.

According to the results obtained, one can state that meat-poisoning organisms are resistant to measures usually employed in pickling. Taking this into account, therefore, it can be stated further that these methods cannot be regarded as a means of rendering infected meat harmless and fit for consumption, particularly if one bears in mind that the period of curing, in the majority of countries, is not more than 21 days.

Summary and Conclusions

1. The bactericidal action of bacon brine on *Sal. typhimurium, Ps. aeruginosa, Staph. aureus, E. coli, Br. suis* and *Proteus vulgaris* has been tested.

2. Experiments were made with pure brine alone and with brine-treated meat in curing temperatures of 8 C., 22 C., and 37 C., at various intervals up to 47 days.

3. Only sound meat should be used for curing. The idea that pickling may render infected meat fit for human consumption is to be condemned in view of the slight and uncertain bacterial inhibiting action of the brine and be-

(*Continued on page* 456)

An Observation On Bovine Hemoglobinuria

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MUCH of our present knowledge of hemoglobinuria in cattle has been reviewed by Smith[1]. He has named the disease idiopathic hemoglobinuria. Pistor and Cardon[2] reported that in Arizona the symptoms and lesions were apparently caused by hemolysis and changes caused by the elimination of the debris associated with hemolysis. The symptoms disappeared when the animals were changed from pasture to dry feed. Schofield[3] observed the disease in cattle on lush pasture; many of them had low hemoglobin levels but no hemoglobinuria.

On June 1, 1949, 70 grass-fed Hereford heifers from Texas were received at an Eastern Illinois farm. On arrival, the animals were turned onto bluegrass pasture for three weeks and then started on ground ear corn. Most of the herd was slow to eat the grain.

On July 18, depression, staggering, loss of weight and extreme anemia were observed in a 600 lb. heifer. The temperature was 98 F.; the rumen was atonic; on auscultation there was evidence of fluid in the pericardial sac. The animal died within a few hours and was brought to the diagnostic laboratory of the College of Veterinary Medicine (case no. M 3600). At autopsy the tissues were extremely pale, petechial and ecchymotic hemorrhages were present on the epicardium, a sanguineous fluid was found in the pericardial sac, a few hemorrhages were present on the serosal surface of the intestines, the liver was markedly friable and icteric, hemorrhages and one hemorrhagic infarct were observed in the kidney, and the bladder was filled with port wine-colored urine.

A suspension of liver in sterile saline was injected subcutaneously into a guinea pig. The guinea pig died in 24 hours, and a large gram-positive rod was recovered from the liver and heart by streaking inoculated thioglycollate broth onto blood agar plates and incubating anaerobically in a Brewer anaerobic jar. This organism was later identified as *Clostridium perfringens*. No effect was observed when cultures of this organism were given orally or intraperitoneally to calves. In further studies, the sera from naturally affected cattle failed to protect guinea pigs against this *perfringens* culture.

Blood and urine samples were collected on July 21 from two other heifers with marked hemoglobinuria. Darkfield examinations of the urine were negative for Leptospira. In one animal, the total leukocyte count was 8,250 per cmm., the erythrocyte count 4,730,000 per cmm., the hemoglobin level 9.5 gm. per 100 ml., and the differential leukocyte count was 12% eosinophiles, 9% neutrophiles, 77% lymphocytes and 2% monocytes. In the other animal, the white cell count was 7,000 per cmm., the red cell count 5,720,000 per cmm., the hemoglobin level 9.5 gm. per 100 ml., and the differential leukocyte count was 4% eosinophiles, 6% neutrophiles, 88% lymphocytes and 2% monocytes. No pathogenic bacteria were isolated on culture of the urine on blood agar and MacConkey's agar or in selenite broth. Blood smears from the two affected animals were negative for blood parasites.

Both animals were treated with whole blood and 5% dextrose solution intravenously but failed to respond. The postmortem lesions in one animal (case no. M 3614) resembled those in the previous case. A hemorrhagic infarct approximately 3 cmm., in diameter was present in one of the kidneys. No Leptospira were found in sections of the liver and kidney stained by the Levaditi technic.

Histopathologic examination of the liver showed widespread centrolobular necrosis with some infiltration of necrotic areas with leukocytes, particularly neutrophiles. Hepatic cells outside the necrotic areas showed some vacuolation; some hematogenous pigment was present. There was a diffuse nephrosis. Some areas showed more severe degeneration than others, but there was no clear-cut line demarking an infarct. The tubules and glomeruli contained considerable eosinophilic material that in some areas appeared flocculent and amorphous. In other tubules it appeared to be gathered into spherical masses of low density. The material in the tubules of the hemorrhagic kidney infarct stained deep red while other

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more hyaline material in the tubules stained blue with Heidenhain's azan stain.

On July 22, four other heifers with hemoglobinuria were observed. One animal was weak and staggering. Their temperatures ranged from 100.2 to 104.8 F. One million units of procaine penicillin with 2% aluminum monostearate were injected intramuscularly into each animal. Each animal was also given 480 gr. of sulfamerazine orally. The following day the weakest heifer died (case no. M 3634). The autopsy findings were similar to those previously described except that superficial ulceration of the abomasal mucosa and orange-brown discoloration of the edges of the folds were present. The histopathologic findings in the liver and kidney were identical with those previously described.

During the following three days, six other animals were isolated and treated in the same way. One of these six animals died. In all, 14 heifers in the herd were affected and five died.

On July 27, all remaining treated animals appeared completely recovered. Forty-eight hours after therapy was started, the urine of all these animals appeared normal.

Sera from the recovered animals were negative to the agglutination test with bivalent *Leptospira icterohaemorrhagiae* and *L. canicola* antigen. The blood calcium and phosphorus levels of the affected animals during the outbreak were within the normal range.

The services of Dr. L. R. Vawther of Reno, Nev., and Dr. L. T. Giltner, Washington, D. C., in studying the culture isolated from the affected animals, Dr. C. C. Morrill for the histopathologic examinations, and the technical assistance of Mr. F. H. White are acknowledged with sincere appreciation.

Summary

Fourteen cases of hemoglobinuria occurred in a lot of 70 two-year-old feeder heifers. Five animals died. The significance of a strain of *Clostridium perfringens* isolated from these animals is not clear. Nine of the ten affected animals treated with sulfamerazine and penicillin recovered.

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Nitrogen content of manure increases with the increase in protein content of the feed.

A diagnosis of bubonic plague was made at the Veterans Administration Hospital in Albuquerque, N. Mex., on January 15, 1950. The patient, a hunter who had shot and cleaned six cottontail rabbits near his home, became ill and developed an axillary bubo. He completely recovered after treatment with streptomycin and sulfadiazine.

Local health authorities began an immediate investigation to determine whether domestic rodents might be a possible source of infection, or if only wild rodents were involved. Results of this survey (*Pub. Hlth. Repts.*, May 26, 1950), revealed plague-infected wild rabbits and rats of the region. No plague was found in domestic rats, which lead to the logical surmise that the patient acquired the infection from the rabbits.

The evidence obtained, implicating cottontail rabbits for the first time in an active plague epizootic, changes the opinion formerly held that they were not too great a hazard to man. Health officers in counties with known active plague foci should warn hunters of the dangers involved in handling and cleaning rabbits.

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The Effect of Bacon Brine on Pathogenic Microorganisms

(*Continued from page* 454)

cause of the length of time required for the destruction of pathogenic organisms.

4. Unclean methods should be avoided in curing plants, since the contamination of bacon brine may lead to deterioration of bacon in storage.

5. The fact that pathogenic bacteria have been shown to survive the pickling process further emphasizes the necessity for having all stages of meat production and processing under adequate veterinary supervision.

Acknowledgment

The authors' thanks are due to Dr. E. S. Fouad, Professor of Pathology and Dean of the Faculty of Veterinary Medicine, Fouad I University, for his kind encouragement and help so freely given.

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EDITORIAL COMMENTS

Variant of Hog Cholera Virus Brings Losses for Second Year

Tests recently concluded by the BAI at the Agricultural Research Center, Beltsville, Md., indicates again, this year, that some of the losses of recently vaccinated hogs were caused by a variant of hog cholera virus that was recognized for the first time in 1949. Many of the regular hog cholera antiserums do not protect against the variant when the dosages used are not appreciably increased over the amount commonly recommended for many years.

The variant was first recognized by Bureau veterinarians last year when it caused heavy losses on some farms shortly after hogs were given the simultaneous treatment. Heaviest losses then were in Iowa, Minnesota, and Nebraska, with scattered "breaks" in other states. The Bureau cannot make an accurate accounting of the losses as neither farmers nor veterinarians are required to report incidence of the disease. Observations this year, however, indicate smaller losses in Minnesota and Nebraska, while losses have been greater in Illinois, Indiana, and Ohio.

Dr. B. T. Simms, Chief of the Bureau, emphasizes again the public announcement made on April 13, this year, when it was strongly urged that "early and increased doses of hog cholera antiserum is the surest means of protecting against a widespread appearance of the disease."

One of the first discoveries was that the variant of the virus is unstable in nature and has a marked tendency to revert to the regular hog cholera virus. This handicapped research but at the time there was hope that because of this tendency the variant might not appear again for some time. Its reappearance this year dashed that hope.

Another fact established thus far is that once pigs or mature hogs are immunized successfully against ordinary virus they are not susceptible to the variant. Other studies have shown that progressively increasing the dose of serum beyond that regularly used brought about progressive decreases in losses.

This information, plus the important fact that suckling pigs farrowed and nursed by immune sows have a high resistance to cholera until weaned, and that little or no trouble occurred in such pigs even though variant virus was used, leads to two highly important recommendations: (1) Vaccinate pigs before they are weaned. (2) Increase the amount of hog cholera antiserum used by roughly 50%. With the regular virus inoculation the Bureau now recommends not less than 25 cc. of serum for suckling pigs; not less than 45 cc. of serum for weanling pigs up to 90 pounds; and ½ cc. of serum for each pound increase in liveweight for heavier hogs. If you are guessing the weight, don't underestimate.

Efforts also were made this year to determine if a variant was present in simultaneous viruses produced in some 31 licensed plants. Early in the year, current virus in all plants was tested against a common serum which would protect against the ordinary virus, but would "break" against the variant. The tests at that time showed no variant present in the current stocks. Under present methods of manufacture, it is impractical to test each serial lot of virus against such a serum in addition to other tests already required because of the large number of test pigs required. At the neight of the virus production season, sufficient numbers of test pigs simply are not available.

Post-vaccination breaks occurred occasionally even before the discovery of the variant last year. The condition of the animals at the time of vaccination is still an important factor. If they are in poor condition or are carrying latent infections of other viruses and bacterial diseases, some losses may occur. The variant also apparently occurs more readily in some pigs than others. This has been shown in field observations where pigs treated with the same serials of virus, later known to contain the variant, are not affected while still other lots come down with cholera. Whether or not these breaks are due to the variant alone or to the condition of pigs at time of simultaneous treatment has not been determined.

Although spot losses have been heavy, the percentage loss country-wide has not been materially affected by the appearance of the variant. Any appreciable decrease in vaccination might well be followed by tremendous losses from uncontrolled spread of the disease itself. For this reason, the Bureau urges continued vaccinations with particular stress on early and heavy doses of serum.

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India has about 170,000,000 cattle, or one-third of the world's cattle population.—*S. N. L.*

Veterinarians Needed for Positions of Veterinary Poultry Inspectors

The Dressed Poultry Inspection Service of the U. S. Department of Agriculture is in need of qualified, graduate veterinarians to fill vacancies.

Due to increased interest in the evisceration of poultry under federal inspection, openings are available in various sections of the country.

Entrance salary is $3,825. per annum based upon a 40 hour, five day week. Compensation is allowed for ordered overtime that may be performed in excess of 40 hours per week.

No written examination is required. Appointments are made on the basis of applications submitted. Opportunities for advancement are excellent.

Veterinarians interested are requested to phone, write or wire any of the offices of the Dairy and Poultry Inspection Division, Production and Marketing Administration, at Philadelphia, Pa., Chicago, Ill., Omaha, Nebr., or Sacramento, Calif.

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Women's Auxiliary Elects New Officers

Officers of the A.V.M.A. Women's Auxiliary for 1950-51 are: Mrs. Dennis Coughlin, Knoxville, Tenn., president; Mrs. C. E. Bild, Miami, Fla., president-elect; Mrs. H. S. MacDonald, Toronto, Ont., first vice-president; Mrs. Russell A. Runnells, East Lansing, Mich., second vice-president; Mrs. L. R. Richardson, Ravenna, Ohio, third vice-president; Mrs. C. L. Miller, River Forest, Ill., secretary; Mrs. C. C. Rife, Atlanta, Ga., treasurer; Mrs. C. M. Rodgers, Blandinsville, Ill., chairman of House of Representatives, and Mrs. A. E. Cooms, Skowhegan, Me., recorder for House.

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The serologic diagnosis of Newcastle disease in man must be made with caution because of the close correlation of complement-fixing activity and antihemagglutinating factors against the viruses of mumps and this disease. This relationship, according to the authors, is best explained by assuming that mumps virus and Newcastle disease virus have a common antigen and that the latter factor develops as a response to infection with mumps virus.—*Jordan and Feller, Jour. Lab. Clin. Med.*, 36:369 (*Sept.*), *1950.*

Complementary Action Between Antibiotics

Facts revealed by investigations at the University of California point up the dangers of simultaneous administration of two or more antibiotic agents now in wide use. In some combinations, notably penicillin and streptomycin, a complementary action exists; joint usage is more effective than the administration of either separately. In other instances, it appears that when given together, combinations are less effective in protecting experimental animals than components of such mixtures alone.

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At the 28th annual meeting of the U. S. Veterinary Medical Association in Washington, September 15, 1891, the name of Theobald Smith, M.D., was proposed for honorary membership, but rejected. The next day Doctor Smith applied for active membership and was accepted.

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Prolapse of the Prepuce in the Bull

In some cattle breeds, there appears a tendency toward prolapse of the prepuce. If this organ is injured, the tissue becomes edematous and finally develops a permanent thickening. A stricture is thus formed and the bull is useless for breeding. Treatment recommended is surgical removal of the thickened portion of the prepuce.—*E. R. Frank, D.V.M.*

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"I would like to see it become a requisite condition to qualify a man to become a member of this association that he should be a member in good standing of his county and state associations."—*Presidential address, 28th annual meeting, U. S. Vet. Med. Assn.*, 1891.

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Prof. William L. Weipers, Director of Veterinary Studies, University of Glasgow, is making a two-month visit in the United States to study the nature and scope of research programs on the subject of calf diseases. His visit is part of the Marshall Plan technical assistance program which makes it possible for European scientists to confer with American workers on subjects which are expected to further European industrial and agricultural production.

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Eighty-nine per cent of all farm products now reach markets by highway truck.

Doctor Draft Bill Becomes Law

On September 9, President Truman signed the Professional Draft Bill passed by Congress in August. This legislation authorizes the President to require special registration on the basis of requisitions submitted by the Department of Defense, of male physicians, dentists, veterinarians, optometrists, pharmacists, and osteopaths, up to the age of 50 years. Persons called under this legislation shall be liable for not more than 21 months of service. Members of Reserve components of the armed forces are not subject to induction under this law.

The following order of priority for registration and induction is specified, in so far as practical and in accordance with the demands of the situation:

1. Those who participated in the Army Specialized Training Program (ASTP), and those who were deferred from military service during World War II in order to complete their professional education and who had less than 90 days of active duty during, subsequent to completion of, or release from, the program.

2. Those mentioned in (1), who had more than 90 days but less than 21 months of active duty service.

3. Those who did not serve in the Army, Air Force, Navy, Marine Corps, Coast Guard, or Public Health Service subsequent to September 16, 1940.

4. Those not included in (1) and (2) who were on active duty subsequent to September 16, 1940. Induction of persons in this priority shall be made in accordance with regulations prescribed by the President.

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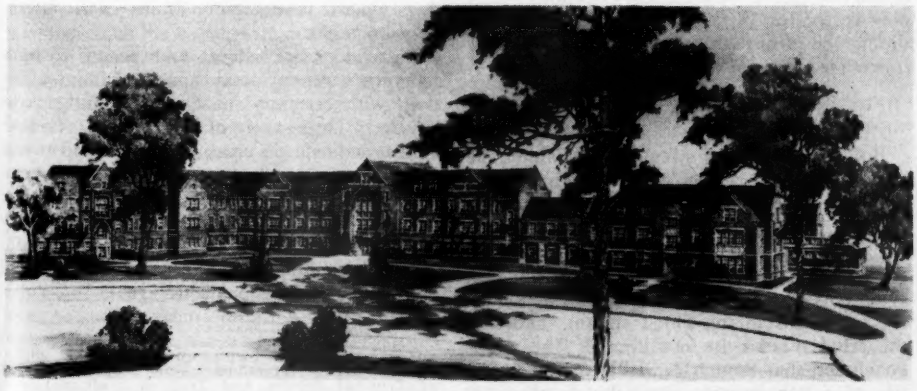
School of Veterinary Medicine at Michigan to Be Expanded

Michigan State College, School of Veterinary Medicine, East Lansing, will have, when present plans are complete, one of the nation's finest centers for training students of veterinary medicine.

Alumni will recognize in the accompanying illustration, two buildings, extreme right and left, that will undergo modernization. The new structure, on which construction was started in June, connecting the present buildings, will be available next year.

According to Dean Claude S. Bryan, one of the objectives of the new center is to better coordinate all phases of veterinary medicine and related sciences under one roof. Provisions will be available for classroom work, research and clinical procedures in the new building. Hospital facilities for large animals will be doubled, new *x*-ray equipment installed, and poultry disease and nutritional laboratories expanded. Special considerations for other research programs now under way at Michigan are additional planned features.

The entire structure, including new and old, will be named Giltner Hall, in honor of the late Dean Ward Giltner.



Architect's sketch of the new building for the School of Veterinary Medicine, Michigan State College, East Lansing. Plans call for a new structure connecting the present anatomy building (extreme left) and the veterinary clinic (extreme right).

Immunization of Dogs Against Leptospirosis

Active immunization against leptospirosis in animals promises a means of protection against a serious illness. Pathological processes progress rapidly and diagnosis in natural infection is frequently delayed. Antibiotics have been shown repeatedly to be valuable and effective in the early stages of infection. Treatment measures frequently are commenced too late to prevent kidney damage.

Meyer and Brunner[49] state that successful control and prevention of leptospiral infections depend upon; (1) the elimination or treatment of mammals which serve as reservoirs of infection; (2) avoidance of contact with contaminated environment; (3) protection of susceptible hosts by prophylactic immunization; and (4) diagnosis and early treatment. Recent reports of outbreaks have indicated that there is a significant incidence of clinical leptospirosis in dogs. Furthermore, serological surveys reveal the fact that unsuspectedly high percentages of various groups of dogs the world over have a titer against leptospira indicative of past or subclinical infection. Incident rates as high as 44% are reported (Belgium), based on blood agglutination titers of 1:100 or over. The disease is being recognized both in man and animals with increasing frequency and is a primary public health hazard.

The accepted explanation of the mode of transmission of the infection is based largely on facts related to intimate contact with carriers of the infection. Apparently healthy rodents and dogs are known to shed in the urine Leptospira that are infective to susceptible hosts. Leptospiruria establishes itself in 59% of dogs suffering from clinical infections which may persist for 18 months or more. Organisms discharged from these carriers are readily transferred among dogs living together.

Antibiotic Treatment

Both penicillin and streptomycin inhibit the growth of Leptospira *in vitro*. Experiment and field reports have been published and clinicians are in general agreement that penicillin administered early in the course of infection, as a rule, is effective treatment. In such cases, symptoms are relieved by the destruction of the organisms in the blood stream. Those in the renal tubules are not injured. Thus, it is concluded that though penicillin may save the life of a dog, it may allow the development of a carrier. Hamsters experimentally infected and treated with streptomycin were not regarded as carriers as no organisms were found in the kidneys or liver of treated animals when brought to autopsy after recovery. It was possible to demonstrate organisms by dark field examination and culture in the kidneys of untreated controls that survived. These observations and many favorable clinical reports prove rather conclusively that chronic renal infections with Leptospira in dogs may be successfully treated with streptomycin. Aureomycin appears to have similar therapeutic value and has the added advantage that it may be given orally.

Prophylactic Inoculation

Protection experiments have been carried out at the George William Hooper Foundation, University of California, San Francisco, on hamsters and dogs. A method of making cultures of virulent Leptospira safe for immunization without reducing their antigenicity was developed[50]. Cultures grown in special media were centrifuged, resuspended in a 10% solution of rabbit serum in saline and lyophilized. Vaccine from avirulent strains of *L. canicola* were also prepared. These antigens proved more effective than chemically killed preparations. In a dose of 0.001 ml. or less, lyophilized *L. canicola* vaccine protected hamsters and in the amount of 0.5 ml. conferred solid immunity on susceptible puppies against challenge with a homologous strain. In this study, postinoculation agglutinin titer served as a useful measure of the degree of protection conferred. These antigens were nonimmunogenic against *L. icterohaemorrhgiae*. Antigens prepared according to the same procedure as for *L. canicola*, using the classical murine strains, confer protection on hamsters and dogs in increased dosage. A two-step inoculation procedure with at least 2 ml. of antigen is required to immunize dogs against homologous strains of *L. icterohaemorrhagiae*.

Since dogs are subject to exposure to both biotypes, a prophylactic capable of immunizing dogs with certainty must contain antigens in relatively large doses of both strains. Present studies indicate no cross protection and reveal the need of a murine strain having a broad immunogenic spectrum. However, prophylactic vaccination confers a high degree of immunity and further work will no doubt result in a dependable combination antigen that may be used with safety as a prophylactic agent.

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VETERINARY PARASITOLOGY

A. O. FOSTER, B.A., M.A., Sc.D.
Beltsville, Maryland

Changing Viewpoints on Parasite Control and Antiparasitic Medication

Those who have kept abreast of developments in livestock parasite control cannot but discern that recent years have seen progress beyond that which is measurable in terms of new and safer drugs. There are, of course, better methods of using them. But there are, also, changing viewpoints, of which one of the most significant is the increasing trend toward the preventive use of medication. This viewpoint, coupled with the wide acceptance by stockmen of preventive measures against parasites, is probably of more lasting significance than any form of medication *per se*. Specific treatments, however valuable, are essentially products of the times and for the times. Only a few treatments that were popular a dozen or so years ago are in wide use today, and it is not improbable that a dozen years hence will see the use of many new drugs in place of those that are relied upon today. It is doubtful, on the other hand, that a sound and challenging method of dealing with the insidious, unspectacular losses caused by parasites among all classes of farm animals can result in anything but increased effort along this line.

The treatment of heavily infested animals, however important as a last resort, is not "a stitch in time." Once heavy parasitism develops, much economic loss has already been suffered. It is the essence of control that animals be maintained as free from parasites as possible. This is important, because there does not appear to be universal agreement on what is meant by controlling parasites. It should not mean, and certainly does not mean in current usage, simply keeping parasites "in check", or "holding the line" against them, or maintaining the *status quo*. If such were the case, problems of controlling parasites would lose much of their challenge and significance. When one speaks of controlling parasites, therefore, he should mean doing the things that reduce to a minimum the economic losses caused by parasites.

Practices and measures of parasite control vary greatly, and space does not permit discussion of them, but it has been noted that antiparasitic medication has proved itself to be a most useful weapon of control. Drugs usually make possible an effective attack on parasites at a vulnerable point in their life-cycle. They make it possible to break the chain at its weakest link. Finally, it must be all too evident that the preventive use of drugs involves their timely, judicious, and systematic use, and that such use is based upon a steadily increasing knowledge of the biology of parasites.

The programs of winter treatment of breeder stock, for example, to which it is especially pertinent to call attention at this season, are predicated on a knowledge that many of the most injurious species owe their perpetuation from season to season to their carry-over in breeder stock, that cold winters afford considerable natural protection against parasites by decontamination of pastures, and that the mature stages of parasites such as are present in breeder stock are not only the "seed-beds" of infection for young animals but also are, as a rule, the most susceptible stages to destruction by chemicals. Therefore, despite the fact that parasite troubles commonly come with warm weather and affect the young stock most severely, experience has shown that these troubles can be avoided most efficiently by the judicious treatment of breeder stocks during the off-season. The free-choice administration of phenothiazine in salt or mineral mixtures, to sheep and goats, either as a grazing season regimen or a year-around practice, is an excellent example of the preventive use of an antiparasitic drug. The modes of action of this measure are complicated and cannot be discussed at this point, but it may be noted that the amounts of the chemical ingested are insufficient for therapeutic effect on adult worms harbored by the flocks. In other words, the drug, under this regimen, is given to prevent parasitism rather than cure it. For this reason, also, it is desirable and necessary to give therapeutic doses of phenothiazine to all members of a flock of sheep or goats, before that flock is placed upon a free-choice regimen.

In the case of hogs, the sodium fluoride treatment has been shown to be effective in removing from the small intestine both immature and mature stages of large roundworms. It is thus, an effective therapeutic

measure, but it becomes an effective control measure when treatment is administered at such times as will achieve a systematic, gradual reduction of roundworm infestation within an owner's herds. Considerations of the life-cycle of the parasite have suggested, therefore, that one treatment of pigs at weaning time and a second treatment about two months later should achieve this objective. Much practical experience supports this hypothesis.

As further examples of preventive measures against parasites, in which reliance is placed upon medication as the key factor in the control program, such diverse practices might be cited as the area-wide control of cattle grubs, the low-level administration of drugs to control poultry coccidiosis, and the intermittent administration of small doses of phenothiazine to control horse strongyles. Indeed, a comprehensive discussion of such measures would be a very large undertaking.

Although some emphasis has been placed upon continuous, small-dose medication, it also has been stressed that therapeutic doses of drugs, when used judiciously and timely, are fully as valuable as adjuncts to parasite control.

At any rate, there is now a firm, wide foundation in both research and field experience to support the view that antiparasitic medication is a powerful weapon of parasite control and that preventive medication, based upon a full knowledge of parasites—their biology as well as their susceptibility to drug action—is destined to be the mark of developments to come. Thus, in prospect, the frontiers for development of parasite control measures are boundless and challenging, in spite of notable progress already achieved.

It should not be forgotten, of course, that the ever-expanding knowledge of parasites makes it altogether clear that good parasite control goes hand-in-hand with good management, wholesome feeding, intelligent breeding, sanitation, and surveillance.

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W.V.M.A. Officers for 1950-51

Officers of the Women's Veterinary Medical Association for 1950-51 are: Dr. Margaret W. Sloss, Ames, Iowa, president; Dr. Patricia O'Connor, Staten Island, N. Y., Dr. Joan Youngs Ziegler, Toledo, Ohio, Dr. Hildegard L. Seelig, Asheville, N. Car., and Dr. Josephine Browne, Laramie, Wyo., vice-presidents, representing eastern, central, southern, and western sections, respectively; Dr. Estelle Hecht Geller, New York, N. Y., secretary, and Dr. Lois Calhoun, East Lansing, Mich., treasurer.

Sterilizing Surgeons' Gloves

On the back of its "Kolor-Sized" glove chart, the Seamless Rubber Company has prepared approved procedures for sterilizing surgeons' gloves, parts of which are extracted herewith.

"1. Wash gloves inside and outside immediately after use, with green soap and warm water. If gloves have been in contact with grease, vaseline, mineral oil or lubricating jelly, soak for 15 to 20 minutes in a good grade of acetone or clean with ether. Rinse in a warm 1% phenol-water solution and dry thoroughly.

"2. When thoroughly dry, test for imperfections and patch where necessary. Repaired gloves should be boiled for three minutes, then dried. During drying, do not allow gloves to remain in strong light, particularly sunlight, nor subject them to drafts.

"3. Powder inside and outside to prevent surfaces from sticking. (Potassium bitartrate is recommended instead of talcum because it is readily and harmlessly disposed of by the body tissues and fluids. It causes no consequent peritoneal adhesions and there have been no complaints regarding undesirable skin effects.)

"4. Turn down cuff 1½" to 2" and insert in glove a gauze pad or similar porous fabric nearly as wide as the glove and about ⅜" thick. Place a small packet of powder under the turned down cuff, so that it will be sterilized and ready for the surgeon when putting on the gloves.

"5. Pair gloves and place in roomy glove packs without cramping. (Glove packs should be kept away from the metal surfaces of the sterilizer.)

"6. Place gloves so that they occupy top half of sterilizer. Stack loosely.

"7. Expose to no more than 15 lb. steam pressure for 20 minutes.

"8. Sterilization by boiling is satisfactory. Completely encase gloves to prevent contact with metal surfaces. Boil for 15 minutes."

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The demand for poultry products has been reflected in spectacular expansion of the industry during the past ten years. Though all livestock products have enjoyed increased consumer demand, that for chicken meat and eggs has been greatest.

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Turkey growers in the United States are raising a record 44,550,000 turkeys this year.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Streptomycin given in drinking water at the rate of 15 gm. per gallon for periods of five to ten days exerted a marked deterrent effect on the development and course of ulcerative enteritis of nine-week-old quail in experiments reported by Kirkpatrick, Moses and Baldini (*Poultry Sci.*, 29:561, 1950).

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Preliminary trials with the use of ethylene oxide gas for disinfecting egg shells have given promising results according to Lorenz, Starr, and Bouthilet (*Poultry Sci.*, 29:545, 1950). In these trials, egg shells were artificially infected by suspension in cultures of Pseudomonas organisms containing approximately 10^6 cells per ml. The gas employed as a fumigant afforded almost complete protection to the previously infected eggs under storage conditions in which similarly infected unfumigated eggs developed a high percentage of spoilage.

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The California Department of Agriculture, Bureau of Livestock Disease Control, has announced that testing facilities for detecting carriers of *Salmonella typhimurium* infection in turkeys will be made available this year to turkey growers. All testing will be done on a voluntary basis, and the cost for the 1950-51 season will be 9 cents per test in addition to the fee charged for the pullorum tests.

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Several reports on the growth-promoting effects of residues from vitamin B_{12} mashes to turkeys have been published recently. These are summarized by McGinnis (*Turkey World*, p.56, July 1950), Stokstad and Jukes (*Poultry Sci.*, 29:611, 1950), and Gorschke and Evans, (*Poultry Sci.*, 29:616, 1950). These writers showed that crystalline aureomycin hydrochloride, streptomycin and penicillin will each produce a growth response in turkey poults when fed at comparatively low levels in the diet, while vitamin B_{12} alone showed no significant effect. The general opinion among nutritional investigators now is that the growth factor in these residue mashes is due to some other product of growth of the organism used rather than B_{12}. The mechanism of these effects remains obscure.

Every effort should be taken to prevent freezing of water fountains. There are many types of heaters available for keeping the temperature of water in fountains at non-freezing temperatures; some are good and some are dangerous. Open flame, oil-burning types should be avoided since they are fire hazards. Electric heaters of the drop-in type for open fountains and soil heater cable types for wrapping pipes are examples of modern methods which are satisfactory.

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Poultry parasites that may attack man are few in number according to a summary of Animal Parasites Reported from Man by Koutz (*Speculum*, 3:33 [Winter], 1950). He lists the following that are found in or on poultry that may also attack man:

The red mite, *Dermanyssus gallinae*, may cause a skin irritation known as poultryman's itch.

The larval form of the chigger, *Eutrombicula alfreddugesi*, may infect poultry, man and other animals but is not transmitted from animals to man.

The chicken lice, various species, may be annoying pests of man but do not remain long on the human body.

One species of nematodes, *Cheilospirura hamulosa*, caused infection of the conjuctival sac of a man in the Philippines.

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Commercial poultry feeds are compounded for specific purposes and are balanced for the type and age of birds for which they are intended. Feeding supplements in addition to such feeds may upset the balance sufficiently to produce a nutritional disorder. Poultrymen should be warned against such practices as feeding milk, or highly concentrated mashes in addition to an already balanced ration. If such concentrates are available, or if a ready supply of milk is available, the feed formula should be changed to allow for the supplements. If you are presented with such a problem, it is good advice to suggest that your client consult his feed dealer to find out what type of a ration is needed to allow him to utilize his own sources of concentrate. Most feed dealers can supply special mixes to use in such cases.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

At this time of the year there are occasional reports of castor bean poisoning. The poisonous principle is the water soluble compound ricin. It is said to be most abundant in the husks. In sufficient amounts, ricin is a severe gastrointestinal irritant so that following its consumption severe illness, characterized by pain and diarrhea, has been observed in all domesticated animals. Sufficient amounts of the poison will cause death. Since ricin is not soluble in fats, the early administration of fatty substances is a rational antidote. Emetics, to animals capable of vomiting, are always indicated.

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The ubiquitous *Salmonella typhimurium* previously isolated from the ovaries of fowl has now also (according to Wilson in *Vet. Rec.*, Aug. 5, 1950) been recovered from the yolks of pullet eggs. Since this species of microorganism is a natural pathogen for many domesticated animals, and as it has been isolated from human outbreaks of food poisoning, this latest development again emphasizes the danger to man in the consumption of uncooked foods of animal origin.

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In regard to unusual routes for the administration of antibiotics, conclusions were reached in staff meetings of the Mayo Clinic that, "aureomycin and terramycin are not absorbed into the blood stream in detectable quantities when administered in the form of a retention enema." It is unlikely that these agents would be therapeutically effective when administered in this manner.

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Quinacrine hydrochloride (atabrine dihydrochloride; atabrin) is reported to be an effective remedy in freeing the intestinal tract of the flagellate protozoan organisms believed to be the cause of giardiasis, a disease frequently characterized by severe diarrhea in man and animals. Doses of 3 to 5 mg. daily given to infected chinchillas weighing from 15 to 20 oz. freed these animals from cysts in nine days; doses of 6 to 9 mg. accomplished the same result in four days.

Can a rabies-immunized dog be a carrier of rabies virus, or in other words, does rabies virus injected into a rabies-immune animal die immediately, or if not, how long does it live in a virulent and transmissible condition? Dr. L. D. Bushnell, Professor Emeritus of Bacteriology at Kansas State College, after a general review of the matter sums up his conclusions as follows: "The evidence available would indicate that immune animals injected with virulent rabies virus are not likely to become carriers for more than a short period, and would probably never become dangerous since the virus would not reach the nervous tissue, and would not appear in the saliva."

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This question came to us: "Has the intrathecal (intraspinal) injection of penicillin been of any value in the handling of chorea following distemper in dogs?" Dr. Roland F. Vetter of the Kansas State College clinic staff replied to this question as follows: "In our experience we have never found that intrathecal injection of penicillin was of any value in treating chorea following distemper. In a very small percentage of cases improvement was effected by adequate diet, and large sustained dosages of vitamin B complex with vitamin C."

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Additional data on the effectiveness of enheptin T (Lederle) for prevention and control of histomoniasis (blackhead) is reported by Seeger, Lucas, and Tomhave (*Poultry Sci.*, 29:610, 1950). In their trials, no losses occurred in a group of turkeys fed the drug at the rate of 0.05% in the mash, while 5.21% died in the untreated groups. In a group fed on a mash containing 0.025% of enheptin T, 2.35% died from the disease.

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In experiments to determine the susceptibility of turkey poults to histomoniasis, Swales and Frank (*Canad. Jour. Comp. Med. & Vet. Sci.*, 12:141 [May], 1948) found that poults exposed to infected chicken house litter became susceptible at three weeks of age. The average period between exposure and death was 22 days and 90% of the poults died.

ABSTRACTS OF LITERATURE

Growth and Fattening of Beef Heifers

Data on feed consumption and weight gains in a group of heifers are reported, indicating beneficial effects of hormone treatment of feedlot heifers and adding evidence that no benefits are derived in the feedlot as a result of spaying[51].

In one experiment, 25 grade Hereford heifers, weighing approximately 500 lb., were divided into five groups. Group I served as controls; animals in group II were spayed; those in group III received stilbestrol implants subcutaneously in the region of the shoulders, dosage 42 mg.; group IV were treated by the intramuscular injection of 50 mg. of testosterone propionate in oil followed by a second injection of 32.5 mg. 56 days later; and group V were given 4 gm. of thiouracil daily per animal mixed in soybean oil meal.

A second experiment duplicated the first. In this 45 heifer calves of similar age and weight were used. These were divided into five groups and treated as in the first experiment except that a dosage of 48 mg. of stilbestrol was used for implantation in group III, testosterone-treated group IV were given 50 mg. pellets implanted subcutaneously, and group V animals received 0.5 gm. of thyroprotein per 100 lb. of body weight daily in the feed. Feeding of all five groups in each experiment was kept constant.

In table summary of the effects of these hormone treatments on the growth and fattening of heifers in the first experiment, the average final weights were greatest for the stilbestrol-treated group. After the 140-day feeding period, these weighed an average of 836 lb., contrasted to an average weight of 795 lb. for the control group and 762 for the spayed heifers. In the second experiment, after a 185-day feeding period, the average weights were reported as follows: stilbestrol-treated, 876 lb.; controls, 821 lb.; spayed, 782 lb.; testosterone-treated, 826 lb.; thyroprotein-fed, 798 lb. Average daily gains in both experiments were highest for those heifers receiving stilbestrol implants. These were reported as 2.32 lb. and 2 lb., in the first and second experiments, respectively.

In both experiments, the spayed heifers required more feed per 100 lb. of gain than any other, except the thyroprotein fed group. The heifers receiving the stilbestrol treatment were reported as easier to keep on feed and in the second experiment had the largest daily feed consumption. Furthermore, the animals on this treatment required less feed per 100 lb. of gain than the other groups in both experiments.

The influence of stilbestrol on the carcass grade was not considered significant. The dressing percentage was equal to other groups, though carcasses from these were noted to be slightly "hooky."

In these experiments, growth rate, feed efficiency, and feed consumption were significantly increased by stilbestrol implantation.

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Hormone Treatment for Fattening Lambs

The possibilities that growth-stimulating hormones may serve to increase the rate of gain in fattening lambs are supported by experiments[52].

Four-month-old lambs treated by subcutaneous implantation, just below the ear, of 12 mg. pellets were full fed with an equal number of controls for 74 days. A second feeding trial of 92 days was set up, using 50 seven- to eight-month-old crossbred lambs. In the first trial, treated lambs gained 0.43 lb. per lamb daily over the entire feeding period while the controls averaged 0.35 lb. In the second trial, treated lambs gained 0.37 lb. per head daily as against 0.29 lb. for controls. These differences were significantly favorable to stilbestrol treatment in stimulating gains in feedlot lambs.

Grade of carcasses of lambs treated when they were four months of age was not affected by the treatment, but the treated lambs of the second trial, which were older, were of a lower grade than the controls.

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Tuberculosis among swine is quite rare.—*N. S. Mayo, Jour. Comp. Med. & Vet. Arch.*, July 1891.

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[51]Dinusson, W. E., Andrews, F. N., and Beeson, W. M., The Effects of Stilbestrol, Testosterone, Thyroid Alteration and Spaying on the Growth and Fattening of Beef Heifers. *Jour. An. Science*, 9:321 (Aug.), 1950.

[52]Jordan, R. M., The Effect of Stilbestrol on Fattening Lambs. *Jour. An. Sci.*, 9:383 (Aug.), 1950.

CLINICAL REPORTS

Equine Intestinal Calculi

DONALD E. TORKELSON, D.V.M.,
Greenleaf, Kansas

The patient, a 14-year-old, black gelding, weighing 1,200 lb., was noticed by the owner to show colicky symptoms while standing in the barnyard. At that time, the animal was tied in a box stall.

Two days later, colic symptoms were again evident. The writer was called shortly before noon and found the horse in a box stall, down, kicking violently and in considerable distress. The head was still held securely by the heavy halter rope tied to the hitching ring.

The horse was untied and led to the barnyard, upon which he suddenly became quite calm and at ease. A rectal examination revealed a hard mass barely palpable on maximum extension of arm and hand. It was not possible to determine whether the mass was within the intestine or outside of it. The external lymph glands were not enlarged.

One gallon of mineral oil was administered by stomach tube. Blood sample was taken which subsequently revealed the blood picture as normal. The horse was released with the suggestion that it be kept in the barn yard.

Twelve hours later signs of mild colic were again observed and 1 oz. of chloral hydrate crystals was given.

On rectal examination the following afternoon, only a slight amount of oil was noted in the rectum; the feces present were still hard and dry. At that time 3 cc. of lentin 1:1,000 were administered subcutaneously. The horse did not appear to be in pain. The owner stated that the animal had eaten a moderate amount of hay and had drunk a considerable amount of water that morning.

One hour later auscultation over the abdomen revealed sounds of stones clicking together. The patient was securely tied in a sharply inclining loading chute, the forequarters at the upper end. On rectal examination one large calculus and several smaller ones could be palpated. The animal was removed from the chute and 1 lb. of sodium sulfate in solution was administered by stomach tube, after which the horse was placed in a box stall for the night.

Several calculi were expelled during the night, among them being the large one which weighed 3 lb., 8 oz. The patient ate well and showed no further signs of pain. A saline enema was administered which assisted in the removal of a total of 13 calculi of various sizes. There was no recurrence of attacks of colic during the subsequent observation period of six months.

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Urticaria in a Cow

CLAYTON STEPHENS, D.V.M.,
Tupelo, Mississippi

When brought into the hospital, the grade dairy cow, shown below, had virtually skinned herself by rubbing. Raw areas were noted over the head, neck and forelegs.

The history elicited from the owner included the fact that several days earlier she was turned into a new pasture that had not been grazed for some months. Within a few hours, wheals were noted over the entire body surface as edematous, circumscribed elevations of varied size. Many had coalesced, presenting extensive areas of involvement, which were accompanied by intense itching.

An antihistamine preparation of thenylpyramine hydrochloride solution (Pyrahistine parenteral solution—Pitman-Moore Company) was administered intravenously in 10 cc. doses every hour for four hours. Supplemental treatment included repeated spray application of a lime-sulfur solution. After the second dose of pyrahistine, itching ceased. At the end of the third day, hair began to slip, coming off in quantity. The picture reproduced above was taken seven days from hospital entrance date. At this time practically all hair, as well as layers of skin, had come off the body. Appetite was regained after the fourth day and an uneventful and complete recovery occurred.

BOOK REVIEWS

Books reviewed in this department and any other books, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 15, Missouri.

THE BIOCHEMISTRY OF B VITAMINS, by *Roger J. Williams, Robert E. Eakin, Ernest Beerstecher, Jr.,* and *William Shive,* of the University of Texas. 741 pages. Reinhold Publishing Corporation, New York, publisher, 1950.—Price $10.00.

The authors, who are biochemists, present in this monograph all the problems concerning the vitamin B complex in such a manner that non-chemists, too, will understand the material which is of special interest to them. Veterinarians will find valuable information in the following chapters: distribution of the vitamins; biogenesis; functions of the B vitamins in metabolic processes; B vitamin requirements of animals and plants; physiological, pharmacological and toxicological effects; B vitamin deficiency states; biotin; the folic acid group; the nicotinic acid group; pantothenic acid; the vitamin B_6 group; riboflavin; and thiamin. Hundreds of literature sources are cited by each of the authors.—*R. S.*

BRUCELLOSIS, a symposium under the joint auspices of the National Institute of Health of the Public Health Service, and the American Association for the Advancement of Science (A.A.A.S.). 255 pages. Cloth bound. A.A.A.S., Washington 5, D. C., publisher, 1950.—Price $4.00.

Summarizing the present knowledge of brucellosis, Malcolm H. Soule, states that "probably no infectious disease of man and animals has been more generally misunderstood and misrepresented than brucellosis."

In this book, a collection of 24 papers presents a complete and exhaustive discussion of various aspects of the disease in man and animals. These have been prepared by authorities in the field of research well known to veterinarians. Discussions are appended by satisfying reference lists.

Facts concerning brucellosis are emerging and becoming well established. During recent years and now continuously, workers in all fields related to this disease are in more general agreement. From this, a planned and manageable program of control and elimination is plausible and expected to reduce further disease incidence in both man and animals.

Feature contents of this book include comments on the early history of human brucellosis, discussions on the physiology and chemistry of Brucella organisms, immunology and epidemiology of brucellosis, clinical aspects and treatment of the disease in man, papers by Dr. C. A. Manthei, dealing with cattle, and by Dr. L. M. Hutchings, with swine brucellosis. Discussions by Doctors Boyd, Traum, Gilman and Simms considering matters of interest to veterinarians, round out the symposium.

Recommended for reading and reference and as source material from which to prepare answers to questions posed on the subject.

FROHNER'S LEHRBUCH DER ARZNEIMITTELEHRE (Textbook of Materia Medica) for veterinarians. Eighteenth revised and enlarged edition, by *Dr. Richard Reinhardt,* Emeritus Professor of Veterinary Pharmacology and formerly Director of the Animal Polyclinic of the University of Leipzig. 400 pages. Ferdinand Enke, Hasenbergsteige 3, Stuttgart, West Germany, publisher, 1950.—Price 29.80 marks (about $7.15).

Dr. Eugen Fröhner's name is one to conjure with in German veterinary literature. This work has the unusual distinction of having been current for 62 years and having reached the 18th edition. Were it published in this country the title would probably include pharmacology, materia medica and medical chemistry since the scope of the work covers those fields. The first 13 editions were by Fröhner. The meticulous thoroughness of Fröhner has been maintained by Reinhardt in the last five editions.

Except that the discussions of the sulfonamides and antibiotic agents are definitely inadequate and the discussions of hormones and organotherapy less than sufficient, this is an excellent work, well adapted for study and reference. Obviously the paucity of discussions of these subjects on which a great deal of new information was developed during and following the war is due to the scarcity of these products in Germany and all of Continental Europe during the war and since. An English translation of this work, with the sections on

biological products, antibiotic agents, hormones and organotherapy, written by an American authority or several authorities, would be a valuable and welcome addition to our literature for both veterinary students and veterinarians.

The text has expanded considerably in the present edition. There has been added also a critical chapter on blood transfusion and blood substitution. The chapters on organotherapeutic products, hormones, endocrines, vaccines, sera, and diagnostics are very clear, specific and concise, but as mentioned in the foregoing, do not contain the latest information available in the United States.

The introduction classifies and defines the various subdivisions of pharmacology, toxicology, and closely related sciences. The contents of the work is grouped chiefly according to functions and drug effects.

Forty-two pages are devoted to hypnotics and narcotizing drugs, which act upon the central nervous system; 23 pages are devoted to antipyretics and local anesthetics; 27 pages to drugs affecting the autonomic system; 13 to those affecting the heart and circulation; 15 to centrally acting excitants; ten to expectorants; then follow chapters on carminatives, emetics, anthelmintics, diuretics, etc.

In the chapter dealing with substances of organic chemical origin, the author discusses the functions of the ring and side chain structure and the importance of the presence in the molecule of certain groups and their significance. In this way, it is easier to understand the action of such drugs as prontosil and the reasons for their peculiar actions. This form of approach makes the methods of administration and the occurrence of occasional untoward effects much more understandable.

The author also discusses trypaflavin, a drug which is deserving of much greater general application than it enjoys in this country.—*C. A. Zell, D.V.M., Ph.D.*

TEXTBOOK OF BIOCHEMISTRY, by *Benjamin Harrow, Ph.D.*, Professor of Chemistry, City College of the City of New York. Fifth edition. 609 pages with 139 illustrations. W. B. Saunders Company, Philadelphia, Pa., publisher, 1950. Price $6.00.

When a scientific book reaches its fifth edition within a mere 12 years, it must be outstanding. Professor Harrow possesses a rare ability to explain difficult or dry subjects in a lively manner, yet systematically and thoroughly. He discusses, among other things, carbohydrates, lipids, proteins, enzymes, vitamins, digestion, blood, immunochemistry and chemotherapy, biological antagonists, respiration, the various metabolisms, urine, and hormones. Among the more recent findings of research and industry described in these and other chapters are many which veterinarians already have learned to use in practice, *e.g.*, protein hydrolysates, amino acids, vitamin B, animal protein factor, histamine and anti-histaminic reagents, tyrothricin, streptomycin, aureomycin, and chloromycetin, estrogens and androgens, etc.—*R. S.*

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Bulletins — Circulars — Booklets

Mineral Needs of Farm Animals.—Contains practical suggestions for provision of minerals for common farm classes of livestock.—Ohio Agr. Exp. Sta., Wooster, Special Circular 49, (Revised).

Comparative Efficacy of Vitamin D from Irradiated Yeast and Cod-liver Oil for Growing Pigs.—Results of five experimental trials substantiate the observations of other investigations and indicate the variation in the requirements of vitamin D by different groups of growing and fattening pigs. Cod-liver oil and irradiated yeast were shown to be comparable, unit for unit, as a source of vitamin D for swine.—Ohio Agr. Exp. Sta., Wooster, Bul. 667.

Crossbreeding for the Production of Market Hogs.—Gives analysis of crossbreeding trials. —Ohio Agr. Exp. Sta., Wooster, Bul. 675.

Bovine Mastitis I: A Study of the Relative Incidence of Various Microorganisms Associated with Mastitis in Pennsylvania Dairy Herds.—This reports a study in 24 Pennsylvania dairy herds extended over a two-year period. Coliform organisms were found to be primary bacterial invaders. In 20% of cases no bacterial forms were isolated in the initial phases of the disease.—Pa. Agr. Exp. Sta., Pennsylvania State College, Bul. 525.

Artificial Insemination in Livestock Breeding.—This bulletin deals with many aspects of artificial insemination in a number of species of farm animals, pets, fur animals and poultry. Examination of semen and methods of handling are detailed. Latest information is given, drawn from many sources and the work of the author, Dr. A. H. Frank.—USDA Circular 567. For sale by the Superintendent of Documents, Washington 25, D. C., price 25 cents.

The Veterinarian's Bookshelf

Listed herewith are some of the newer and useful books of veterinary interest. These and any other books, if available, may be obtained by remitting the purchase price to the Book Department, VETERINARY MEDICINE, *Suite* 803 *Livestock Exchange Building, Kansas City* 15, *Mo. Books will be mailed postage prepaid anywhere in the United States only.*

Diseases and Practice

Bovine Mastitis—Ralph B. Little, *et al.*	$ 7.00
Bovine Trichomoniasis—Banner Bill Morgan	3.25
Diseases of Genital Organs of Domestic Animals—W. L. Williams	10.80
Diseases and Parasites of Poultry—E. H. Barger and L. E. Card	4.00
Diseases of the Pig and Its Husbandry—D. J. Anthony	4.00
Diseases of Poultry—H. E. Biester and L. H. Schwarte	10.50
Diseases and Parasites of Rabbits—Marcellus W. Meeks	2.50
Diseases of Small Domestic Animals—Oscar V. Brumley	5.00
Index of Diagnosis—Hamilton Kirk	8.00
Index of Treatment —Hamilton Kirk	8.00
Infectious Diseases of Domestic Animals—W. A. Hagan	6.50
May's Manual of Diseases of the Eye—Charles A. Perera	5.00
The Practice of Veterinary Medicine—D. H. Udall	7.50
Radiology in Small Animal Practice—Gerry B. Schnelle	8.00
Veterinary Obstetrics—W. L. Williams	8.10

Surgery

Animal Castration—George R. White	$ 7.50
Atlas of Surgical Operations—Cutler-Zollinger	9.00
Canine Surgery—H. Preston Hoskins and J. V. Lacroix	12.00
Experimental Surgery—J. Markowitz	7.00
Hobday's Surgical Diseases of Dog and Cat—James McCunn	4.50
Veterinary Surgery Notes—E. R. Frank	5.00
Williams' Surgical Operations—A. G. Danks	2.50

Diagnosis

Clinical Laboratory Methods and Diagnosis (3 vol.) R. B. H. Gradwohl	40.00
Diagnostic Methods in Veterinary Medicine—George F. Boddie	3.50
Manual of Clinical Laboratory Methods—O. E. Hepler	8.50
Pregnancy Diagnosis Tests—Alfred T. Cowie	4.00
Principles of Hematology—Russell L. Haden	5.00

VETERINARY SURGERY NOTES
DISEASES of POULTRY
BRUCELLOSIS IN MAN AND ANIMALS
THE PHYSIOLOGY OF DOMESTIC ANIMALS
THE PRACTICE OF VETERINARY MEDICINE

Therapeutics and Biochemistry

Textbook of Biochemistry— Phillip H. Mitchell ..... $ 5.00
Veterinary Pharmacology, Materia Medica and Therapeutics—H. J. Milks 10.00

Bacteriology

Bergey's Manual of Determinative Bacteriology— $15.00
Dairy Bacteriology—J. D. Hammer 6.00
Dairy Bacteriology and Public Health—C. S. Bryan 1.00
Disinfection and Sterilization—E. C. McCulloch 6.50
Manual of Veterinary Bacteriology—R. A. Kesler and Harry W. Schoening 6.50
Principles of Bacteriology and Immunity—Topley and Wilson 14.00
Veterinary Bacteriology and Virology—I. A. Merchant 8.50

Pathology

Animal Pathology—Russell Runnels .... $ 7.00
Brucellosis in Men and Animals—I. F. Huddleson 3.50
Manual of Veterinary Clinical Pathology—David L. Coffin 4.00
Neoplasms of the Dog—R. M. Mulligan 4.00
Pathology and Therapeutics of Diseases of Domestic Animals (3 vol.)—Hutyra, Marek and Manninger 50.00

Anatomy and Physiology

Anatomy of Domestic Animals— Sisson and Grossman $14.50
Guide to the Dissection of the Dog—Malcolm E. Miller 5.00
Physiology of Domestic Animals—H. H. Dukes 7.50
Topographical Anatomy of the Dog—O. Charock Bradley 4.50

Parasitology

Introduction to Parasitology—Asa C. Chandler ..... $ 5.50
Outline of Veterinary Entomology and Helminthology—J. H. Whitlock 3.00
Veterinary Clinical Parasitology—Edward A. Benbrook and Margaret W. Sloss 4.50
Veterinary Helminthology—Banner Bill Morgan and P. A. Hawkins 7.00
Veterinary Helminthology and Entomology—H. O. Mönnig 7.00
Veterinary Protozoology—Banner Bill Morgan and P. A. Hawkins 4.00

Public Health and Hygiene

Federal Food, Drug and Cosmetic Act 1938-1949—Vincent A. Kleinfeld and Charles W. Dunn $17.50
Immunity Principles and Application in Medicine and Public Health—Zinsser, Enders and Fothergill 7.50
Meat and Meat Foods—Loyd B. Jensen 3.75
Meat Hygiene (Edelmann)—John R. Mohler and Adolph Eichhorn 5.50
Public Health and Hygiene—Charles Boldman 4.25
Textbook of Meat Inspection—Horace Thornton 12.50

Nutrition

Animal Nutrition—L. A. Maynard .... $ 5.00
The Avitaminsoses—Eddy and Dalldorf 4.50
Essentials of Nutrition—Henry C. Sherman and C. S. Lanford 3.85
Feeding Poultry—G. F. Heuser 4.50
Feeding Our Dogs—Leon Whitney 3.50
Feeds and Feeding—Henry and Morrison 7.00
Nutrition of the Dog—Clive McCay.... 3.50
Poultry Nutrition—W. R. Ewing 12.50

Dictionaries

American Illustrated Medical Dictionary—W. A. Dorland ..... $ 8.50
Blakiston's New Gould Medical Dictionary— 8.50
Stedman's Practical Medical Dictionary—Stanley Garber 7.50

Miscellaneous

Animal Breeding—A. L. Hagedoorn .... $ 5.00
Animal Sanitation and Disease Control—R. R. Dykstra 3.50
Brucellosis, A Symposium—A.A.A.S. 4.00
The Complete Book of Home Pet Care—Leon Whitney 4.95
Diseases Transmitted from Animals to Man—Thomas G. Hull 11.00
How to Raise Rabbits for Food and Fur—Frank Ashbrook 2.00
Management and Feeding of Sheep—E. T. Baker 3.50
Modern Dog Encyclopedia—Henry P. Davis 10.00
Planning Your Animal Hospital—A. A. H. A. 3.50
Poultry Production—Lippincott and Card 4.00
The Semen of Animals and Its Use for Artificial Insemination—James Anderson 2.00

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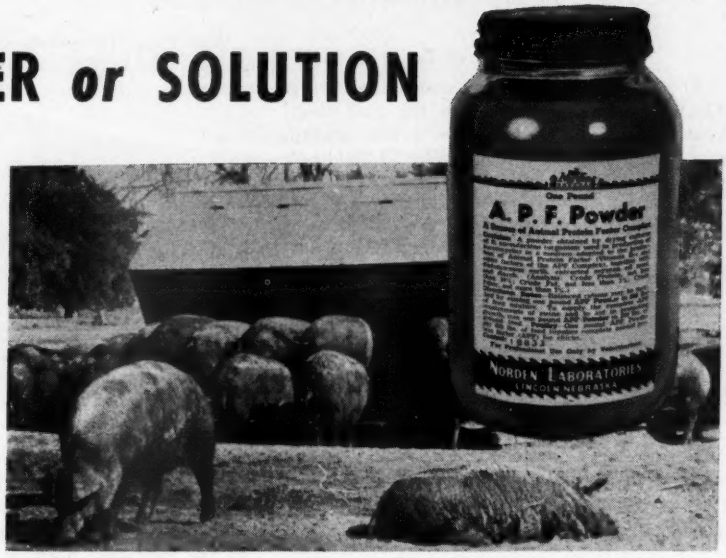

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VETERINARY ITEMS OF INTEREST

With the introduction of new and improved antibiotics, indications for sulfonamides are becoming ever more restricted.

▼

Use of triple sulfonamide mixtures, now widely used, reduces the incidence of crystalluria frequently reported following the use of a single drug of the sulfonamide group.

▼

The American Hereford Association reports 426,971 animals recorded in the past fiscal year. This number constitutes a new record, exceeding figures of a year ago by 57,000 head.

▼

Each year, each month, in fact, every day, medical science and technology put new weapons into the hands of the practitioner in his fight against the processes of disease and for maintenance of health.

▼

Premedication and smooth induction of general anesthesia, designed to avoid psychic trauma in naturally apprehensive patients of the veterinarian, is recognized as paramount by the modern practitioner.

▼

The weekly radio program, known as Juvenile Jury, sponsored by Gaines Dog Foods, Division of General Foods Corporation, returned to the air over a mutual network on Sunday, October 8, at 3:30 p.m., Eastern Standard Time.

This program, popular with children, collected a number of citations and awards last season. Women's groups have commended performances for child audiences.

▼

The Venezuelan government has set up an institute, which will be attached to the Ministry of Agriculture, to plan and execute the campaign against foot-and-mouth disease in that country. Officials from the United States and Mexico have arrived there to assist in the program. Thus far the outbreak seems to have been confined to a comparatively small section.

One of the early observations of modern immunology was that blood has the power to destroy bacteria.

▼

Swine of either sex and all ages are susceptible to brucellosis.—*L. M. Hutchings, D.V.M.*

▼

Miraculous recoveries are reported on the use of swine erysipelas antiserum in hogs suffering the acute form of the disease.

▼

It would be sensible merchandising to sell eggs by the pound, as practically all perishable foods are now priced.

▼

The problem of handling soft corn for best utilization will confront many livestock producers this fall. Preparation as silage will recover the maximum of feed value per acre.

▼

In Denmark, a cow herd may be officially designated as brucellosis-free if it successfully passes three ring tests, four to six months apart, followed by negative serum agglutination tests on the individual animals.

▼

Artificial insemination does not surpass natural breeding in percentage of pregnancies per service, but when semen from fertile males is used properly, it may nearly equal it.

▼

An automatic Bunsen burner that flames only when needed, by touch control, is now being manufactured by Hanan Engineering Co., Buffalo, N. Y.

▼

First public demonstration of Vericolor, the new color television system developed by Columbia Broadcasting System and Remington Rand, Inc., for commercial and industrial use, will be a feature of the National Business Show at the Grand Central Palace, New York, during the week of October 23.

COLIBACILLOSIS

white scours
infectious diarrhea
enteritis in calves

PENOVOXIL SQUIBB

Because Novoxil* is useful internally as well as externally Squibb has combined the original silver oxide base with cupric oxide . . . and offers this product as Penovoxil** Capsules.

Clinical experiments over a period of years have established the value of Penovoxil in the *control of* colibacillosis (white scours, infectious diarrhea, calf enteritis). For treatment when infection is known to be present, two Penovoxil Capsules are recommended three times daily for two to five days.

Penovoxil is also indicated for calf coccidiosis, ulcerative enteritis and colitis. Penovoxil is suggested for use by both large and small animal practitioners.

Penovoxil Capsules Squibb are available to veterinarians in bottles of 25 and 100, priced at $1.05 and $3.90 respectively.

For further information, address Department VM-12, E. R. Squibb & Sons, *Veterinary and Animal Feeding Products Division,* 745 Fifth avenue, New York 22, N. Y.

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